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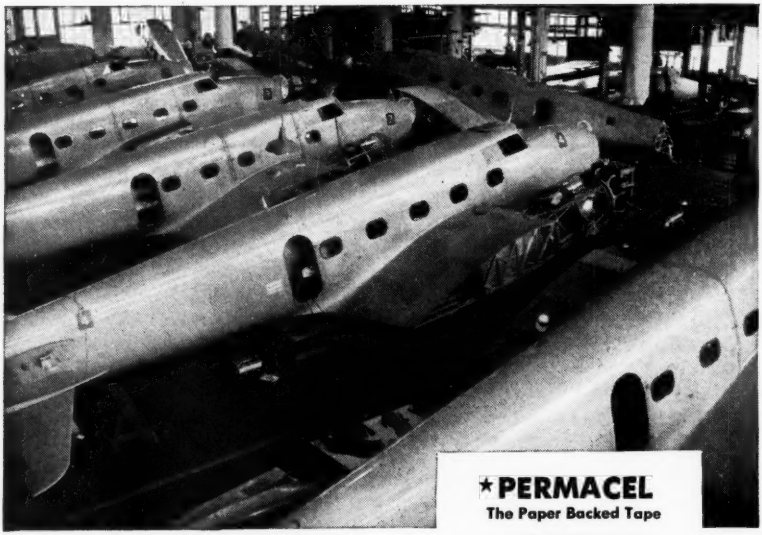

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CINCINNATI, OHIO VOL. 4, NO. 5

FEBRUARY, 1940

ELECTRODEPOSITION OF NICKEL FROM NICKEL CHLORIDE SOLUTIONS

By W. A. WESLEY AND J. W. CAREY
Research Laboratory, The International Nickel Company, Inc.

From a paper read February 3rd before the Baltimore-Washington Branch of The American Electroplaters' Society. Published by special permission of The Electrochemical Society.

THE use of nickel chloride as the principal ingredient of nickel plating solutions has had an unusual and interesting history. It was early proposed for nickel refining electrolytes on a commercial scale, as in the Hoepfner, the Savelsberg-Wannschoff, and the Browne processes, which established the fact that very thick deposits can be made from a chloride bath. For some reason or other those interested in nickel plating paid no attention to the information developed by the refiners. It is true numerous baths containing the single chloride salt as the principal ingredient, with ammonium salts, boric acid or other additions, were suggested at different times for electroplating, but they seem to have met with little favor. Langbein[1] sums up the old opinion about them as follows: "There are a large number of general directions for nickel baths, of which nickel chloride, ammonio-nickel chloride, nickel nitrate, and so on, form the active constituents, and yet it would be a grave mistake to

[1] *Langbein-Brannt, "Electrodeposition of Metals," 8th Edition, p. 306 (1920).*

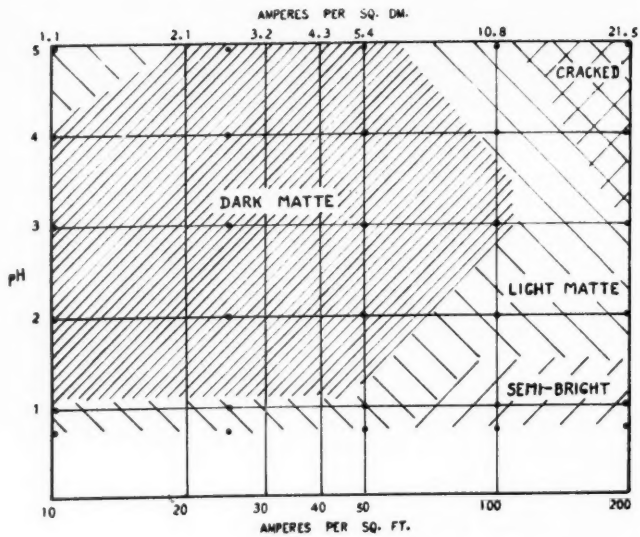


Fig. 1—Plating ranges of chloride bath at 130° F. (54° C.).

use these salts for nickeling iron, because the liberated acid, if not immediately and completely fixed by the anodes in dissolving, imparts to the iron objects a great tendency to the formation of rust. Iron objects nickeled in such a bath, to be sure, come out faultless, but in a short time, even if stored in a dry place, portions of the nickel layer will be observed to peel off, and by closely examining them it will be seen that under the deposit a layer of rust has formed which actually tears the nickel off."

In contrast with the literature on refining, no important studies of high chloride plating baths were recorded until recent years. Blum and Kasper[2] investigated the deposition of thick layers of nickel at unusually high current densities from chloride as well as from sulfate solutions. Their purpose was to develop a method for rapid deposition of a relatively ductile nickel free from strains. Most of their solutions contained no boric acid since this agent was found to have little effect under the conditions used. These workers found that deposits from the chloride baths were invariably more brittle than deposits from sulfate baths of the same pH. All the data they presented were obtained in solutions operated at the boiling point and at current densities above 200 amp./sq. ft. (22 amp./dm.^{2}). The deposits from the chloride solutions did possess other characteristics which would be desirable for some purposes. They were of a finer-grained structure, smoother surface and higher tensile strength and hardness. The presence of only 25 per cent of nickel chloride in a sulfate bath made the deposits almost the same as those from pure chloride solutions. It was noted that the cathode current efficiency was always much higher in the chloride than in the sulfate baths.

More nearly conventional plating conditions were employed by V. Waite[3] who studied a series of plating solutions in which from 0 to 100 per cent of the nickel was present as chloride. Although the experimental work was limited to deposition at only one value of pH for each solu-

[2] *Blum and Kasper, Trans. Faraday Soc., 31, 1203 (1935).*

[3] *V. Waite, Monthly Rev. Am. Electroplaters Soc., 24. 183 (1937).*

tion tested, the results warranted the conclusion that increasing the chloride content of the electrolyte leads to increase in cathode efficiency, together with an increase in hardness and decrease in grain size of the deposits.

Pinner and Borchardt,[4] although concerned chiefly with the behavior of anodes, noted that increase in the chloride content of their nickel sulfate plating bath improved the smoothness of the deposit, and increased the cathode efficiency and throwing power of the solution, especially at low pH.

Solution Composition

It was decided at the outset of this investigation to select one solution composition and learn as much as possible about the characteristics of both the bath itself and the deposits made from it. The simplest chloride bath would be one containing only nickel chloride. Preliminary experiments, however, indicated that sound deposits could be obtained over a wide plating range only if a buffer were present. The maximum nickel content suitable for commercial operations without excessive drag-out losses was considered to be 75 g./L. Addition of boric acid as a buffer to the nickel chloride solution was all that was found necessary to provide a plating bath capable of producing good deposits under properly correlated conditions of bath temperature, pH and current density.

Chloride Bath. The bath composition selected for intensive study was the following: $NiCl_2.6H_2O$, 300 g./L.; H_3BO_3, 30 g./L. Technical nickel chloride was first dissolved in water and its solution was purified by agitation with an excess of nickel carbonate, followed by saturation with chlorine gas in the presence of the nickel carbonate. The solution was then filtered and diluted as to contain 75 g./L. nickel. Finally, chemically pure boric acid was added in the required amount. A portion of the original purified solution was kept in a separate container. This was added to the plating bath as required to replace samples withdrawn

[4] *Pinner and Borchardt, Proceedings of the 1938 Convention of the Am. Electroplaters' Soc., p. 84.*

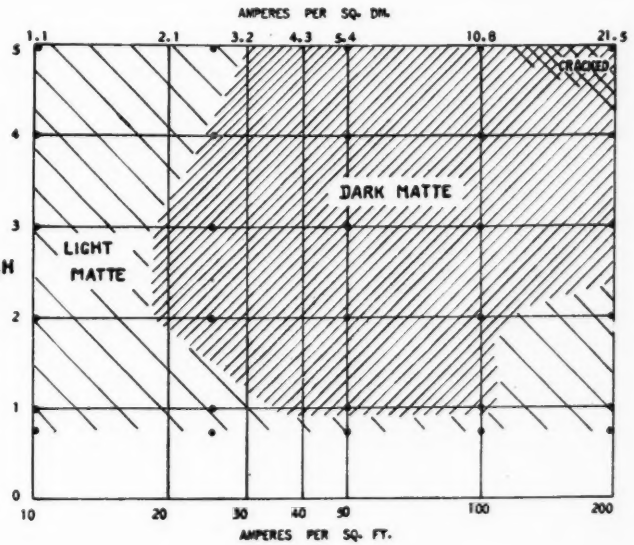


Fig. 2—Plating ranges of chloride bath at 150° F. (66° C.).

Table I.

	Type of Deposit			
	Dark Matte	Light Matte	Semi-Bright	Soft Sulfate
Solution Composition:				
$NiCl_2.6H_2O$ .....g./L.	300	300	300	16.5
$NiSO_4.7H_2O$ .....g./L.				336
Ni .....g./L.	75	75	75	75
H_3BO_3 .....g./L.	30	30	30	30
Conditions for Deposits Used for Tensile Tests, Hardness Determinations and Photomicrographs.				
Cathode Current Density:				
Amp./sq. ft.	75	100	100	36
Amp./dm.^{2}	8.1	10.8	10.8	3.9
Temperature:				
°F. ± 2°	150	140	130	130
°C. ± 1°	65.6	60	54.4	54.4
pH (Electrometric) ± 0.2.....	3.0-4.0	1.2	1.0	2.0
Conditions for Deposits Used for Porosity, Exposure and Erichsen Tests.				
Cathode Current Density:				
Amp./sq. ft.	50	100	100	50
Amp./dm.^{2}	5.4	10.8	10.8	5.4
Temperature:				
°F. ± 2°	140	130	130	130
°C. ± 1°	60	54.4	54.4	54.4
pH (Electrometric) ± 0.1.....	4.0	2.0	1.0	4.0

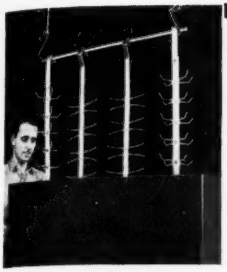
Plating Conditions Selected for Representative Deposits

for pH and quantitative analysis. Determinations of nickel content were made periodically. The nickel content thus recorded was always within the range 75-80 g./L. Operation of the bath invariably resulted in rise of the pH which was corrected before each experiment by addition of chemically pure hydrochloric acid. When it was desired to change the pH to a higher level, this was accomplished by adding nickel hydroxide and filtering.

Later in the work, when it was found that interesting and useful results had been obtained, the principal conclusions were verified with solutions prepared from chemically pure ingredients.

Sulfate Bath. Many of the properties of the chloride bath and of deposits from it were compared directly with those of a Watts-type sulfate bath. The composition of this bath was one which was standard for many years in this laboratory, where a considerable amount of information had been accumulated concerning its characteristics: $NiSO_4 . 7H_2O$, 336 g./L.; $NiCl_2 . 6H_2O$, 16.5 g./L.; H_3BO_3, 30 g./L. This solution was made from chemically pure salts and was filtered and analyzed for nickel (75 g./L.) and chloride (5 g./L) content before use.

Agitation. The solution was slow-



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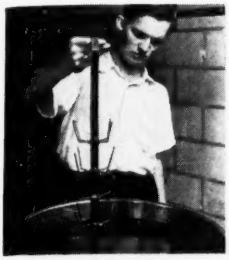

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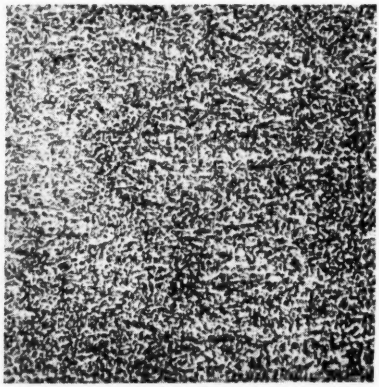

Fig. 3—Structure of dark matte deposit. Section parallel to direction of growth of deposit. Magnification, 500 x.

chimney so that bubbles could not impinge directly upon the cathode.

Pitting. Pitting was troublesome only in the first day or two of operation of a new chloride bath. The solutions were worked until pitting ceased. No additions to prevent pitting were made to the chloride bath. The aeration mentioned above may have acted as a mild preventative. With the sulfate bath, however, hydrogen peroxide was added once a day in the amount of 0.4 cc. (30 per cent H_2O_2 solution) per liter of plating bath to prevent pitting.

Plating Range of Chloride Bath

The first work undertaken was a qualitative survey of the effects of temperature, cathode current density, and hydrogen ion concentration upon the appearance and nature of the deposits. A twelve-liter glass battery jar was used as the plating tank with two anodes, each 20 cm. wide, 25 cm. long and 0.4 cm. thick. The temperature of the plating solution was maintained constant $\pm 1°$ C. by thermostatic control. No anode bags were used. The cathode in each experiment was a piece of 18-gauge deep drawing quality steel 7.6 cm. wide by 15.2 cm. long, suspended vertically from a cathode bar. The bar was moved mechanically in such a way that each point on the cathode surface moved continuously in a vertical circular path of 5 cm. diameter at 30 cycles per minute. The cathodes were prepared for plating by degreasing, alkaline cleaning, pumice scrubbing, dipping in muriatic acid solution and rinsing. The time of plating was selected to yield deposits of an average thickness of 0.001 inch (0.025 mm.). The current density reported was the average current density and in recording the appearance of the deposits it was borne in mind that there had been a higher current density at the edges and a lower at the center of the cathode than the average value.

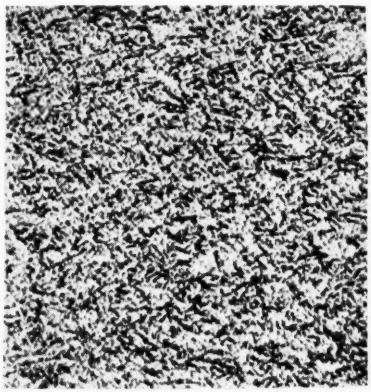

Fig. 4—Structure of semi-bright deposit. Section parallel to direction of growth of deposit. Magnification, 500 x.

The survey was conducted at three temperatures, namely, 130, 140, and 150 deg. F. (54, 60, 66 deg. C.) but

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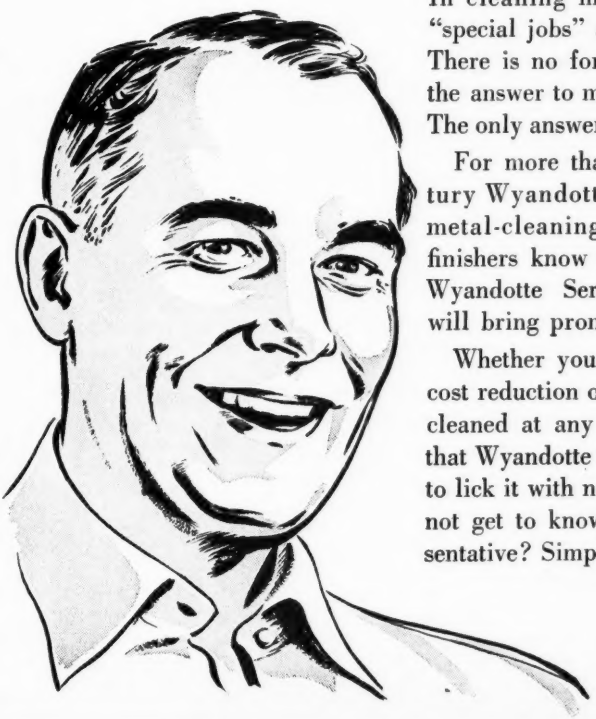

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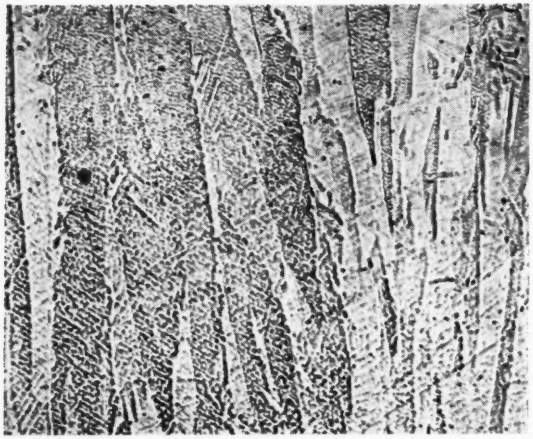

Fig. 5—Structure of deposit from sulfate bath. Section parallel to direction of growth of deposit. Magnification, 500 x.

the results are given for only two temperatures since the intermediate temperature yielded medial results. Figures 1 and 2 show that sound deposits are obtained over a very wide range of plating conditions, cracked deposits being encountered only when a high current density and a high pH were employed simultaneously. The positions of the boundaries of the regions shown in these figures are only suggestive, since there is a gradual, not a sharp, change from one type of deposit to another. Each dot shown in the figures represents the conditions maintained in one experiment.

Characteristics of the Deposits

Three types of appearance were presented by the sound deposits within the ranges of the variables investigated. All three were considered good deposits. The descriptive terms "dark," "light," and "semi-bright" refer only to the as-plated surface appearance and are not to be construed as colors characteristic of the nickel metal.

The "dark" matte coatings were slate-colored and possessed a velvet-like sheen. They were darker in color than any deposits ever observed by the writers from other plating solutions. That the color was only a surface phenomenon was readily shown by rubbing with an eraser, which brought out the ordinary gray appearance of matte nickel deposits. It was easy to imagine that the dark color was confused by earlier workers with the dark and burnt appearance sometimes encountered in imperfect nickel deposits and that this discouraged them from further study of the chloride bath.

The "light" coatings most nearly resembled typical matte deposits from the Watts sulfate solution. The light plates differed from the sulfate type in that they appeared to be very fine-grained and displayed little or no surface "crystallinity" or texture generally associated with the latter type.

The third type, "semi-bright" deposit, was very smooth and light in color, resembling a mirror with a fogged surface. This type was obtained only in a narrow range of conditions at very low pH and high current density.

The plating conditions selected for production of representative specimens of each type of deposit in the work which follows are those given in Table I unless other conditions are specifically stated.

Metallographic Examination. Heavy

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deposits about 0.3 mm. thick were prepared for metallographic examination in cross-section normal to the base. All three types of deposit were found to be very fine-grained in comparison with nickel made from the sulfate bath under the standard conditions. The structures of the dark and the semi-bright deposits are shown in Figures 3 and 4, respectively, while the light matte deposits were intermediate in structure between the other two. All the deposits from the chloride bath showed very little evidence of a fibrous structure; indeed, it is difficult to distinguish in the photomicrographs that the direction of growth of the metal was vertical, from bottom to top as Figures 3 and 4 are printed. Contrast this with the columnar, relatively coarse-grained, structure of the soft nickel plated from the sulfate bath, as shown in Figure 5.

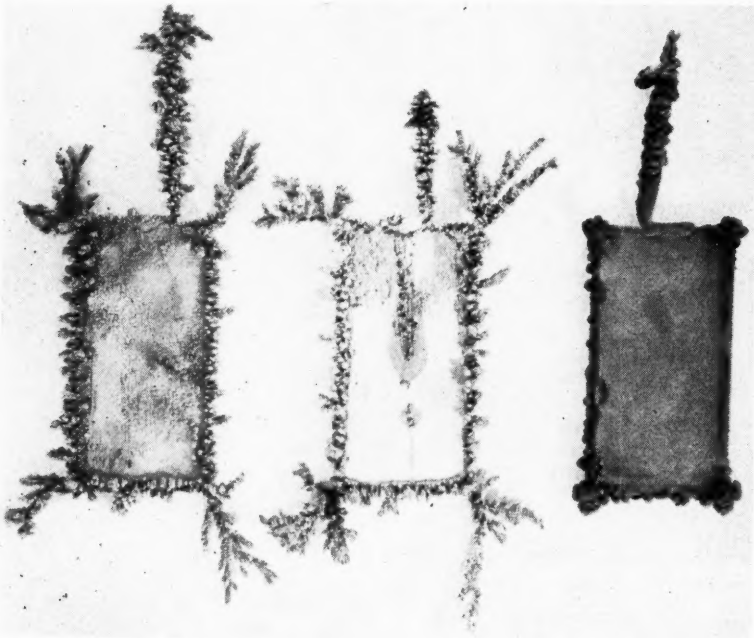

Fig. 6—Thick deposits made under conditions conducive to excessive treeing. Left: From sulfate bath without anode bags. Center: From sulfate bath with anode bags. Righ: From chloride bath without anode bags. ¼ natural size.

Nodules and Treeing in Heavy Deposits. The ordinary sulfate plating solution shows a rather strong tendency toward production of nodules upon the surface and edges, and "trees" at the corners of the cathode when thick deposits are made. This tendency increases rapidly as the current density is increased and makes difficult the production of smooth, heavy deposits at a high rate. Nodules which form upon the surface areas of cathodes are believed to be caused chiefly by the adherence of

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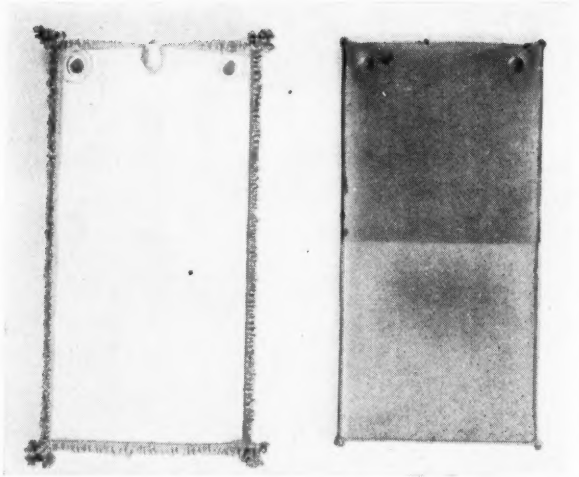

Fig. 7 — Deposits 0.02 inch (0.5 mm.) thick. Left: From sulfate bath with bagged anodes. Right: From chloride bath without anode bags. (Note: Lower half of deposit from chloride bath scrubbed with a bristle brush.)

solid particles, particularly conducting particles, to the cathode. At edges and corners nodules grow without the foreign particle stimulation. The chloride bath was found to be greatly superior to the sulfate bath in producing deposits with smaller nodules and trees. This is at least partly explained by the greater rate of nucleation in the chloride solution evidenced by the fineness of grain of its deposits. It is also probable that conducting particles like nickel or nickel oxide dissolve more rapidly in the chloride bath than in the sulfate, hence it is easier to keep the bath free from them in the former case.

The deposits illustrated in Figure 6 were prepared from the chloride bath and the regular sulfate bath at pH 4, temperature 140 deg. F. (60 deg. C.) and a current density of 100 amp./sq. ft. (10.8 amp./dm.^{2}) based upon the initial area of the steel cathodes. Slight air agitation was employed but there was no cathode motion. Anode bags were not required or used in the chloride solution. The plating time was 17 hours. The average thickness of the deposit away from the edges was about 0.05 inch (1.27 mm.) in the chloride experiment, whereas that of the deposits from the sulfate bath was appreciably less, due to the fact that metal was wasted at the edges and in the trees. The chloride deposit showed the characteristic dark color which would mislead the plater accustomed to handling ordinary nickel into the belief that the metal was not sound.

The plating conditions selected above were purposely chosen to encourage edge growths. The superiority of the chloride electrolyte was evident, however, even under milder conditions of plating. The deposits pictured in Figure 7 were made under similar conditions to those of Figure 6, but at only 50 amp./sq. ft. (5.4 amp./dm.^{2}) and to a thickness of only 0.02 inch (0.5 mm.).

The second installment of this article will appear in the March issue.

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GIVING THE PRODUCT SALES APPEAL

The author tells how and why many manufacturers spend extra money for beautifying their products to decrease sales resistance.

By Francis A. Westbrook

THE Sandy Hill Iron & Brass Works, Hudson Falls, N. Y., manufacturer of paper mill machinery, has added one per cent for finish to the cost of a new machine for the sole purpose of decreasing sales resistance. This is one of the many new examples of the modern trend in the direction of improved surface appearance. The manufacture of paper mill machinery comes under the classification of heavy industries, and as such must practice long range planning.

One of the customers of The Sandy Hill Iron & Brass Works decided to modernize one of its most important items of mechanical equipment and thereby increase production approximately 100 per cent. In constructing this new and revolutionary machine for the customer, The Sandy Hill Iron & Brass Works decided that it would be excellent business to make it look its part. In the first place, applying an especially pleasing appearance to the machine would make the customer feel that he had made a wise selection. Secondly, the management of the plant where the new machine was to be installed permits plant visitation at regular intervals. Quite naturally, a new machine with greatly increased production would excite interest on the part of others in the business and the more attractive and well constructed it was made to appear, the better would be the chance of selling it to those who see it. A view of the completed unit after installation in the customer's plant is shown in Figure 1.

In marketing heavy and expensive machinery of this kind it is obviously necessary to plan ahead, as already mentioned, and the "dressing up" of a new machine such as one manufactured by this company was looked upon as pioneer work. Tangible results cannot be expected for some time, however, since the machine under discussion has been in operation for only a few months. Even so, much interest of a favorable kind has already been aroused and many inquiries have already been received. This is particularly gratifying, as there is nothing to prevent any paper mill machinery builders from constructing similar equipment, but the advantage to the builder of the first machine is obvious and the equally obvious thing to do is to drive home that advantage as hard as possible. A very important detail in doing this has been the care given to the surface finish. In other words, the extra attention given to the surface finish

has been well worth the time and effort used.

The extra finish, which actually has little, if anything to do with the operation of the machine, is very simple. It consists primarily of chromium plating fittings and trimmings such as bearing caps, levers, and so on which greatly enhance the neat and attractive appearance of the machine. This has been carried out completely so that the machine appears as expensive and efficient as it actually is.

The Bailey Meter Company, Cleveland, Ohio, provided another interesting example of a concern which has followed the same trend of improving the finish of its product along with other details of modernization of design. Bailey meters, from the time of their introduction in 1916, remained substantially the same in appearance for many years, but were finally redesigned to take advantage of new developments in the use of materials.

Figure 2 shows a view of a boiler meter before, and Fig. 3 shows a view after, modernization. These two illustrations depict clearly the changed appearance. The most conspicuous change is the substitution of a 14-gauge pressed steel casing for a heavy cast iron casing formerly used. The new casing is as strong mechanically as cast iron, weighs 50 lbs. less, and is consequently easier to handle and is more pleasing in appearance.

Furthermore, it is possible to apply an excellent surface finish on the pressed steel casing with maximum economy. After the case has been fitted with the metering equipment, it is washed and then Bonderized to prevent a breakdown of the surface finish. The exterior is next sprayed with a primer and two coats of surfacer. The interior is sprayed with a

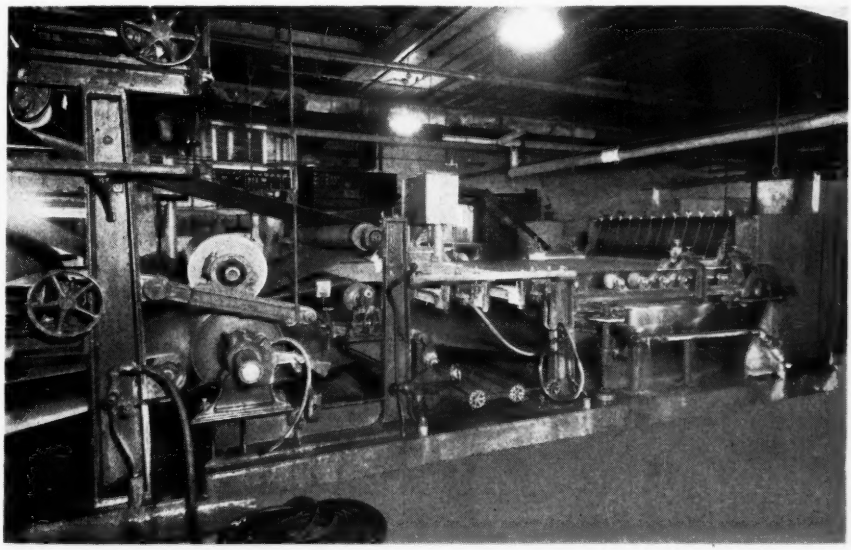


Fig. 1—View of a newly designed and attractively finished paper mill machine.

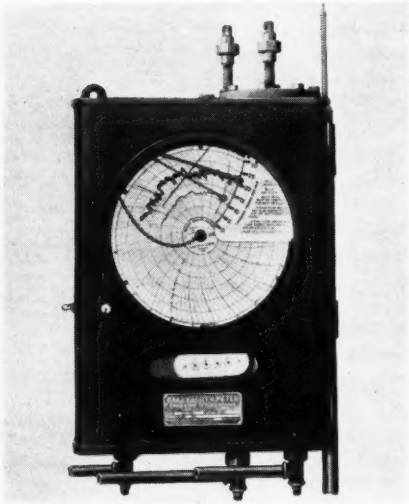


Fig. 2—View of a Bailey boiler meter before restyling.

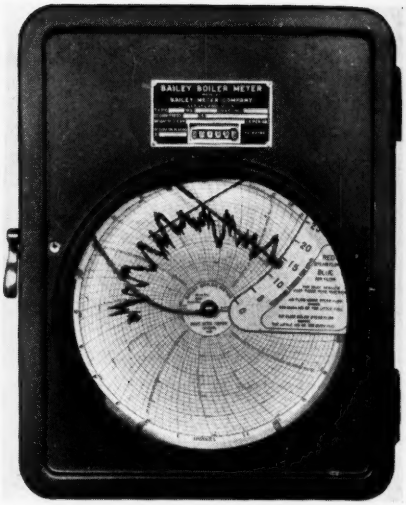


Fig. 3—View of a Bailey boiler meter after restyling.

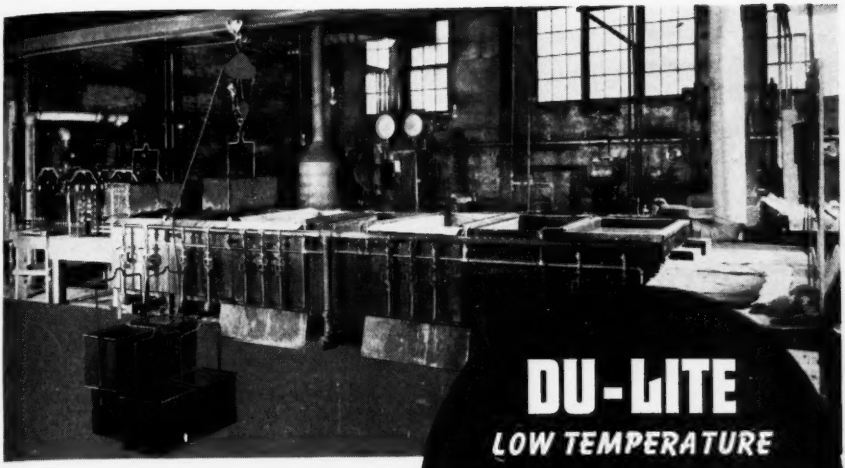
mixture of aluminum paint and white lacquer to provide a color which will reflect light on the metering parts.

After calibration has been completed, a final outside finish of black satin lacquer is applied. This finishing sequence is much more elaborate than the old finishes but the resulting improvement in appearance is well worth the extra expense, according to the manufacturer. The owners of the metering equipment are proud of their installations. This pride of ownership reacts to make the meters a profitable investment by creating sufficient interest in them to stimulate their full and complete use, and of the operating information which they provide.

Another very important result of the use of pressed steel casings is that the same type can be used for almost the entire line of Bailey meters, while the old cast iron casings were not so flexible. The appearance of an installation is now always uniform regardless of the variety of recording meters of which it is a part. Unlike the former design, the new casing may be mounted either on a wall or flush on a steel plate panel, making possible the very efficient and pleasing control panels which can now be seen in practically every modernized boiler plant. The panels on which the meters are mounted are finished with the same type of material as the meter casing so that an up-to-date combustion control installation appears as neat and businesslike as the switchboard which is its counterpart in an electrical generating station.

The meter casing shown in Fig. 3 is equipped with a larger and better looking handle for the door. The larger handle is chrome plated. In addition to this, the new meter now has a molded plastic indicating scale with lettering which is plainly legible.

A very interesting comment on the need of dressing up metal products



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was expressed by Mr. R. C. Taft, manager of the Wallingford, Vt., works of the American Fork & Hoe Company. The brand, "True Temper," has been well advertised and is well known. But, as Mr. Taft says, "The name means little if the thing does not look attractive."

A line of hand tools, including forks, rakes, and hoes, has been made in Wallingford for a hundred years. In the early days, the main emphasis was on strength and sturdy construction for heavy service. The original firm of Batchellor & Sons was the first to develop graceful, light-weight fork tines which were amply strong for the work. In more recent years, with salability as the objective in the face of increased competition, it was found necessary to finish so as to include color, as well as graceful lines and fine proportions. As a result, every item of every grade in the line of hand agricultural tools manufactured by the American Fork & Hoe Company is made just as attractive in appearance as possible, from farmers' manure forks to the ladies' gardening tools.

The question of attractive appearance has a two-fold importance to the management of the American Fork & Hoe Company. In the first place, eye appeal is of great value in the seed or hardware store, as it makes possible an attractive display, in the same manner as fine packages in other lines of goods. In addition to this, there is the satisfaction experienced by the one who has a handsome implement to work with, and in many instances, at least among gardeners, the owner takes considerable pride in the looks of his tool room.

The American Fork & Hoe Company spends thousands of dollars a year for dressing up its products. Without the dressing up, it would be impossible to carry on the business. What is actually being done is well illustrated by the new line of Garden Club tools just being offered to the trade. This line consists of nine items especially designed for amateur gardeners and, as might be expected, careful attention has been given to the finish. The metal parts are well polished and certain portions of the surfaces have a coating of bronze. For example, the ladies' hoe has a polished blade and gold bronze ferrule, and the broom rake has the

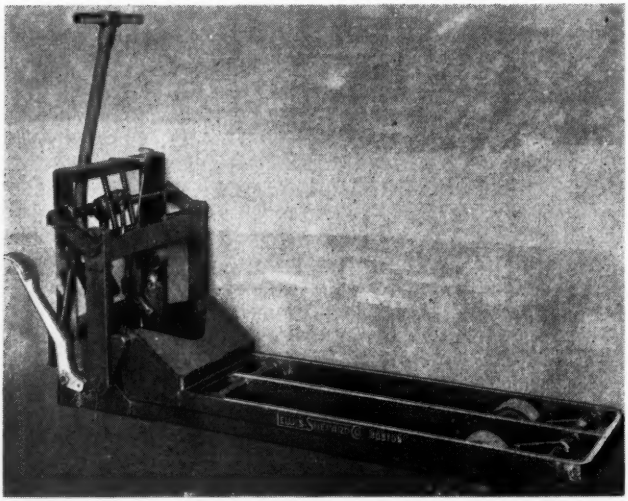

Fig. 4—An attractively finished lift truck.

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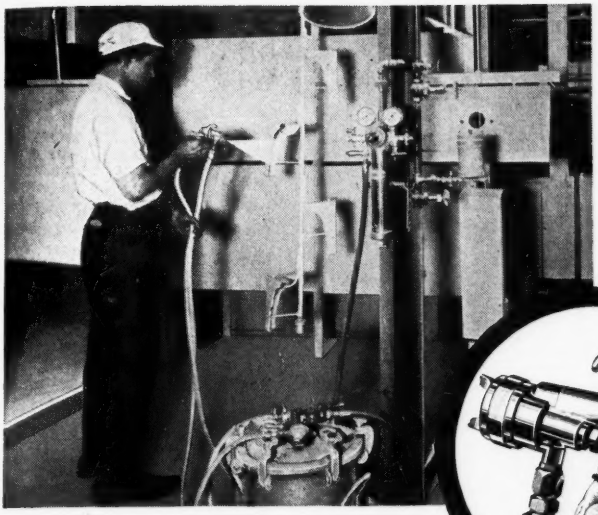

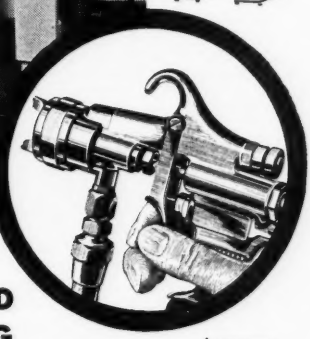

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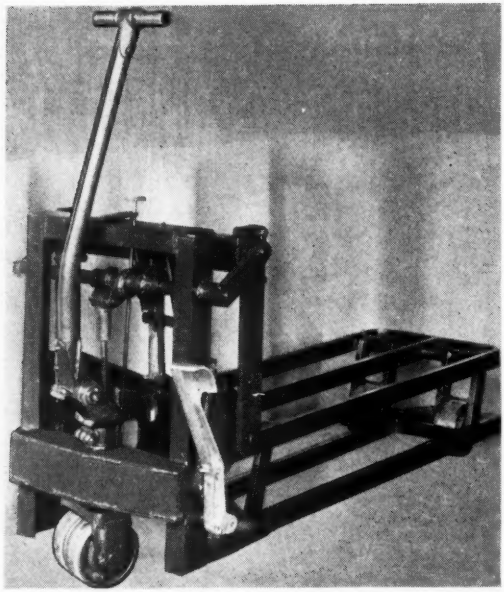

Fig. 5—This type of lift truck is finished for appearance as well as utility.

flexible spring steel teeth and head coated with the gold bronze finish. The wooden handles have a lacquer finish in lavender, yellow, or orange. In addition, each tool has a foil label in six colors which is very durable and gives a decidedly attractive touch.

Other hand tools for farm use are finished with no less care although somewhat differently. The teeth of rakes, tines of forks, and blades of spades, shovels, and hoes are highly polished and certain parts are given a gold bronze finish. Other portions of the metal of some implements are lacquered in various colors, the shade depending on the grade. All wooden handles are now given a dip treatment which acts as a preservative and also makes the grip smooth. A new air-conditioned department has just been installed to take care of this extra finishing operation. Before dipping, the handles are put through fourteen operations to make the surface smooth and absolutely free from splinters. Finally, foil labels are applied to the handles which have been worked out in attractive designs to suggest the detailed care given to the manufacture of these high grade products.

The result of all this attention to finish is that the products are attractive in appearance, as the purchaser has a right to expect. Without the finish, the same implements would look crude and of poor quality. Of course, it may be said with perfect truth, as Mr. Taft pointed out, that tools of poor quality may be dressed up just about as attractively, and often are. This makes it only the more necessary to consider looks when finishing quality items.

The Lewis - Shepherd Company, Watertown, Mass., has a different problem with respect to the appearance of its material handling equipment. For instance, consider the lift truck. It is a well-known fact that this type of equipment receives extremely rough treatment—probably as much as any type of factory equipment. Not only is it knocked around but, what is worse, usually receives very little maintenance. Many users neglect to lubricate their lift trucks and stackers.

Notwithstanding the hard usage to which this equipment is subjected under service conditions it is felt necessary, as explained by Mr. R. Hastings, the company's chief engineer, to dress up the products with a finish

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of practical color and durability. Customers would probably resent a crude, unfinished appearance on a truck or stacker even though it would function mechanically just as well as a painted item. For this reason, an olive green enamel has been chosen which, when accidentally chipped, will not show too sharp a contrast with the bare metal beneath. Two views of Lewis-Shepherd lift trucks are shown in Figures 4 and 5.

Lift truck handles are livened up with a bright red paint—a color valuable not only from the viewpoint of appearance but also from the safety angle. Since the handles project upward from the truck it is important that they be seen at all times by passing workmen who might bump into them. The metal grips of the handles are polished to provide a bright, smooth surface to grasp. Lift trucks equipped with rubber-tired wheels have the metal hubs finished in the same brilliant red as the handles to accentuate the smartness of the general appearance of the truck.

Despatch Bulletin No. 72. A new Despatch Controlled Combustion Direct Air Heater designated as DG-250 is described in Bulletin No. 72 now being issued by Despatch Oven Company, 622 S. E. Ninth St., Minneapolis, Minn. The Despatch Direct Gas Fired Heater described is an air heater with controlled combustion. According to the bulletin, controlled combustion is a novel back-pressure baffle arrangement that is said to assure maximum operating efficiency at all times by a simple twist of a convenient adjusting dial. The construction details and operating features are described on page three of the bulletin.

Made in all sizes, and having capacities from 75,000 to 1,000,000 BTU per hour, the Despatch Direct Fired Air Heater with controlled combustion is said to be ideal for quickly and easily converting obsolete ovens, dryers, and furnaces into modern, high-speed units that will improve results, decrease processing time, and lower operating costs. The new Despatch unit is recommended for all new ovens, dryers, and furnaces with a maximum operating temperature of 1,250 degrees F. This would include drying ovens and finish baking ovens.

A copy of Bulletin No. 72 will be sent free upon request.

Black & Decker Portable Electric Tools. The Black & Decker Mfg. Co., Towson, Md., has just issued a catalog which covers completely the entire Black & Decker line of portable electric tools. This catalog includes illustrations and descriptions of sanders, buffers, portable grinders, and so on. A copy will be sent free upon request.

Demonstrating a technique of smothering fire with carbon dioxide gas. The tank afire contains a quantity of an inflammable material.

(Photo Courtesy Walter Kidde & Co., Inc.)

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METAL COLORING THEORY AND PRACTICE—PART 2

By Joseph B. Kushner, Ch.E.
Electroplating Consultant, N. Y. C.

IN metal coloring, as in many of the applied arts and sciences, there is tendency to rule by rote. At one time or another, an alleged authority on the subject states that a solution of so-and-so produces a beautiful blue color on low brass. This statement gets into a magazine or journal and eventually becomes formula 23 A on page 35 of Whoozis's Handbook For Harried Metal Colorers. The formula is printed and reprinted year after year. Each new crop of platers tries formula 23 A on page 35 and finds that instead of giving a beautiful blue it produces a mottled red, or perhaps, nothing at all. Nevertheless, formula 23 A keeps on getting published, hardy perennial that it is, untouched and unchanged.

The reason for this is not hard to find. Platers, the men who actually do metal coloring for a living, are preeminently practical. They generally do not have the time or the inclination to sit down and write letters to the editor telling him that formula 23 A on page 35 doesn't work. Instead, only a few of the plater's close cronies learn that the formula is bad, if they haven't already found it out for themselves, and formula 23 A on page 35 goes on its inky way, false chemical pronunciamento to mislead succeeding crops of platers and colorers.

Situations of this kind occur quite frequently. A famous historical example of this "formula by dogma," is the case of patina. In 1786, Fourcroy, a French chemist, stated that patina, the beautiful blue green crust or coating that forms on cuprous metals that are exposed to the weather, consisted entirely of the basic carbonate of copper. For almost 150 years this scientific myth persisted unchallenged. Then in 1934, an American chemist by the name of Vernon decided to actually test and analyze the composition of patina with a view towards finding a method for producing this finish artificially. On analysis, he found that patina was for most part either the basic sulphate or chloride of copper, depending on whether the cuprous metal had an inland or seaboard exposure.

The reason for this rather long introduction to an article on the practical side of metal coloring, is this: At the outset, this writer determined to himself that any formula given here would be one that actually worked. All formulas, with few exceptions, were personally tested by the writer in his own laboratory to make sure they were not "dogmatic duds." In the exceptional cases where the formula or method could not be actually assayed by the writer, the source as well as the qualifications are given. The metal finisher who applies the formulas printed here will find them workable and practical.

A few more words are necessary before we bear down on the subject

of practical metal coloring. In the first place, while the rest of this paper will feature the shop angle, we will pause for a moment every now and then whenever theory raises its complex head to explain it briefly with a few phrases. In the second place, the arrangement of the subject will differ somewhat from the stock treatment usually afforded material on metal coloring, inasmuch as we will consider the coinage metals first, gold, silver and copper, in the sequence given, and work our way down to the more common metals.

Gold

Gold is probably the oldest metal known to the coloring art. It has been used in coins and jewelry since ancient times. Only as late as 1927 a piece of research disclosed the fact that the ancient Egyptians mixed gold with small quantities of iron to produce particularly beautiful color effects on ornamental vases.

The natural color of gold in a massive state is yellow. It does not corrode or tarnish in air and is not perceptibly attacked by any of the common single acids or reagents. Its rich color, combined with the fact that it withstands the action of perspiration and other corrosive influences makes gold the ideal finish for costume jewelry, novelties and metal specialties.

Because pure gold (24 karat metal) is quite soft, it is generally alloyed with other metals for the purpose of hardening it. A secondary reason (sometimes primary) for alloying is to reduce the cost of the finished product. Some of the alloying metals produce paler shades of yellow varying almost to white, some redder shades and some, greenish tints. In a solid gold alloy if we are told that the gold is 18 karat, we know that 18/24 or 75 per cent of the alloy by weight is pure gold. We can deposit gold by electroplating that looks exactly like 18 karat but on analysis will be found that the gold content is over 22 karat or more than 92 per cent. In view of this fact it cannot be claimed that a given gold bath will deposit 18 karat gold; one can only say that it will deposit gold of an 18 karat **shade.**

An exception to this rule, perhaps, is the case of a gold plating bath used in Great Britain about three years ago for which was claimed a deposit that looked like 18 karat gold and analyzed as the 18 karat metal. The writer experimented with this bath and found that only with careful chemical control was such the case. Under ordinary plant control, of the type that would be given a bath by a practical plater, considerable variation in the quality of the deposit would be encountered.

Another exception is the Bek process,* as improved by Weisberg in which gold alloyed with other metals is deposited to a definite karat, but even here the solution must be held under constant supervision of a competent chemist in order that the karat be maintained at a standard value.

In view of these facts it can almost be called academic to state that a given bath deposits a 14 karat shade, for in all alloy baths, control is so difficult and variations in temperature, agitation, current, and so on, produce so many different effects, a whole range of different colors can be plated from the same bath. It is a matter of common knowledge that a simple gold bath containing no alloying metal can be made to plate a wide variety of colors by varying some of the factors mentioned pre-

*Patent controlled by L. Weisberg Inc., N. Y.

viously. With this thought in mind, we can consider some of the baths for producing gold colors.

Yellow Golds

The writer has found the following formula to produce excellent, rich shades of yellow.

Ingredients	Oz. per Gallon
Sodium gold cyanide	.80
Sodium cyanide	.60
Sodium di-phosphate	.50
Sodium pyrophosphate	.20
Sodium carbonate	.10
Temperature	130-160 degs. F.
Voltage	3-8 volts

No fixed temperature or voltage is given for the operation of this bath. The reason for this is that we are only concerned with the color we can obtain from it. Every person has his own particular likes and dislikes in the matter of color, especially when it comes to gold. This bath is capable of producing so many shades, therefore, it is best to leave a margin of color control, subject to the following general modifications: First, if current density is increased the yellow will tend more to the red side; second, if free cyanide is increased the deposits will become paler; third, if phosphates are reduced the gold becomes redder in hue; and fourth, if temperature is reduced, current density remaining the same, the deposits become redder.

The **pale yellow** or lower carat shades of gold can be obtained by increasing the free cyanide content of the yellow gold bath to about 1.5 oz. per gallon and adding about .2 oz. per gallon of nickel cyanide. Alternative additions are palladium, zinc, cobalt or mixtures of these metals in soluble salt form. Increasing the phosphate content or adding ferrocyanide ions to the bath will tend to produce the same effect (reduction of karat).

Red Golds

Pleasant shades of gold varying from reddish to pale pink, can be obtained from the following bath:

Ingredients	Oz. per Gallon
Sodium gold cyanide	.8
Copper cyanide	.6
Sodium cyanide	2.0
Sodium pyrophosphate	1.0
Temperature	130-160 degs. F.
Voltage	2-8 volts

Introduction of other alloying metals such as nickel, palladium, zinc, cobalt, silver and cadmium, produces peculiar variations in color, some of which go under the names of "optical pink," "suntan," and so on. These terms are practically meaningless, as no attempt has ever been made to standardize all the possible shades of pink gold.

Rose Golds

The rose gold finish is an interesting type of gold color that has found popularity as a finish for toilet sets and novelty jewelry. It gives a two-toned effect and is generally applied to surfaces with considerable relief. On the lowlights the deposit appears greenish brown to pinkish; on the highlights, it appears a rich yellow. Several solutions and methods are available for obtaining this finish. One that the writer has found quite satisfactory is the following:

Ingredients	Oz. per Gallon
Potassium ferrocyanide	2.0
Sodium gold cyanide	.5
Sodium cyanide	.25
Sodium carbonate	4.0
Temperature	175 degs. F.
Voltage	6-7 volts

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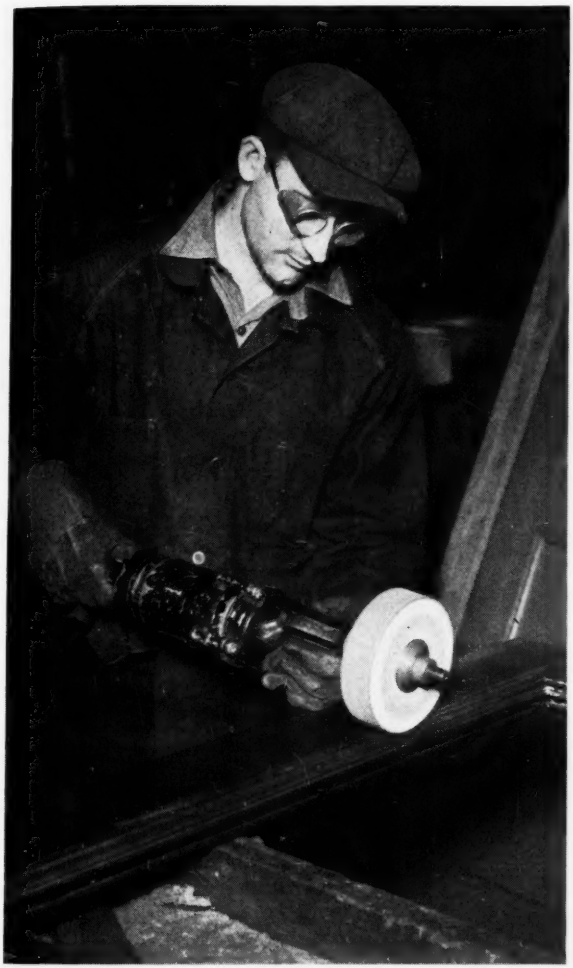

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After plating the work in this solution, the highlights are relieved with sodium bicarbonate and the work is given a flash in a yellow gold solution such as the first one described.

Green Golds

The green shades of gold are produced by alloying gold with silver and (or) cadmium. A typical formula is the one given here.

Ingredients	Oz. per Gallon
Sodium gold cyanide.....	.8
Silver cyanide	.1
Sodium cyanide	1.0
Sodium diphosphate	1.0
Temperature..130-160 degs. F.	
Voltage .....5-7 volts	

Cadmium can be used to wholely or partially replace the silver. If so used, the cadmium should be added in the form of the oxide. The balance between the white metals and the gold is rather delicate.

Increasing the amount of white metals present beyond a certain point will make the bath plate out metal of sickly, yellowish white shades. Another idiosyncracy of this type of bath is the fact the deposits are rather prone to corrosion.

Deeper greens ranging from medium to sea green can be produced by carefully mixing small amounts of either arsenious oxide or lead acetate to the above bath. These reagents should be dissolved in a minimum quantity of cyanide before being added to the plating solution. The addition of hydroxyl ions to the above bath will tend to produce smutted, antiqued effects. Increasing the amount of arsenic or lead will give freak color effects such as grey, brown or purplish golds.

Antique Golds

Since gold is not readily attacked by sulfides, oxidizing agents, and so on, no direct antique effects can be obtained. Any antique effects must come from the pretreatment of the basis metal or else from the deposition of another metal or compound over the gold. The only exception to this is the case of antique green gold previously described.

A method this writer found convenient for producing interesting antique effects was the following: Flash the basis metal with a thin layer of copper from a cyanide bath. Dip the copper plated object in a solution of liver of sulphur plus a little ammonium hydrosulfide until completely discolored.

Now, momentarily immerse the work into an alkaline electrocleaning bath, making it cathodic. This reduces the copper sulphides, forming a heavy black smut. The smut is now relieved wherever desired with a little bicarbonate of soda and the object is flashed in a regular gold solution such as the one described under yellow golds.

A variation of this is to dip the work, after the black smut has been produced and relieved, into a cyanide silver bath containing about 2 oz. per gallon of silver cyanide and 3 oz. of sodium cyanide per gallon. The smutted object is held in the solution for no more than a second. This permits a silver deposit to form by immersion on the highlighted portions. Now the work is rinsed and flashed in a yellow bath. This gives particularly beautiful effects.

Flashing of an antique green finish in a yellow bath gives rise to an antique finish that is currently finding great popularity on novelty jewelry.

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White Golds

During the past few years white gold as a finish has fallen out of fancy. However, there can be no doubt that the cycle is soon ready to swing over to the white golds. Unfortunately, true electrodeposited white golds tend to have yellowish casts and for this reason the common white gold finish is not gold, but rhodium, chromium or tin.

It is possible to produce white gold alloys by the use of nickel in the plating bath that do not have any yellowness of color. Because of the fact that nickel by itself does not deposit from cyanide solutions it has been commonly thought that nickel will not deposit from a gold bath in sufficient quantity to affect the color of the gold. This is not so. Experiments carried on by the writer have proved to him that nickel will codeposit with gold in sufficient quantity to produce excellent white deposits. This fact has since been corroborated by Raub and Bihlmaier. The reason that no deposit has been obtained by platers who have tried it, is that insufficient current has been used. The current density must be very high, much more than is customarily used for other golds. Here is a solution that will plate white gold.

Ingredients	Oz. per Gallon
Sodium gold cyanide	.5
Nickel cyanide	1.0
Sodium cyanide	2.0
Sodium carbonate	1.0
Sodium diphosphate	1.0
Temperature	130-160 degs. F.
Voltage	8-15 volts

The deposit will be found to contain about 10-15 per cent nickel and while a little dark in cast can be buffed up to a brilliant finish.

Heat Treatment Golds

If a layer of gold is deposited over a layer of silver or gold is deposited over copper and subsequently heat treated, green and red colors result, respectively, because of the actual diffusion of one metal into another to form true alloys. The temperature at which this diffusion takes place is considerably below the actual melting point of the metals involved. The diffusion alloy colors would seem to be unimportant inasmuch as practically the same colors can be obtained by the codeposition of the metals mentioned. The subject is brought up, however, because it may be possible by the use of heat to get some unusual color effects.

It was pointed out by Gray[1] that if gold is codeposited from a cyanide bath with a little silver and indium and heat treated, a beautiful light blue color results. Another color idea which suggests itself is depositing aluminum from an organic bath[2] on a layer of gold then heat treating in a reducing atmosphere. This should produce a layer of exquisite "purple gold," a compound of aluminum and gold. This beautiful gold color which is a brilliant purple, has been produced by alloying the solid metals, so there is no reason why it shouldn't be formed as a surface layer in the above manner.

It may be possible that at some time in the future much more stress will be placed on these heat diffusion colors but the high temperatures involved offer considerable drawback to coloring gold in this manner. For the present, reliance will have to be drawn on practical codeposition methods of the type described here for the coloring of gold.

---

[1] Daniel Gray — Trans. Electrochem. Soc. 65. p. 377, 1934.

[2] U. S. Patent 2,170,375. Aug. 1939.

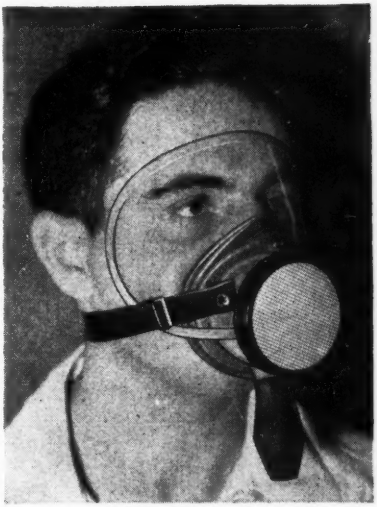
Everything for the Pickling Room. A four-page folder entitled "Everything for the Pickling Room" is now being issued by The Klaas Machine & Manufacturing Company, 4314 E. 49th St., Cleveland, Ohio. This folder describes and illustrates Monel baskets and rubber covered steel baskets for pickling operations. Many companies now using Klaas equipment are listed in this folder.

A copy of "Everything for the Pickling Room" will be sent free upon request.

Paint Progress. A new publication entitled "Paint Progress" is now being issued by The New Jersey Zinc Company, 160 Front St., New York, N. Y. In "Paint Progress" will be found intimate glimpes into the paint research carried on by this company. On page three of the first issue is an article dealing with the value of paint as fire protection. On page five of the same issue is found some interesting data on service records of paints for water tanks. This new publication will be of interest to all those who use finishing materials. Copy free upon request.

DeBothezat Bifurcator. A new ventilating unit designed to remove corrosive, toxic, high temperature, and hazardous fumes is fully described in the illustrated 12-page Bifurator Catalog just issued by American Machine and Metals, Inc., DeBothezat Ventilating Equipment Div., East Moline, Ill. The DeBothezat Bifurcator, which takes its name from the word "bifurcate," meaning "to separate," consists of an axial-flow pressure fan mounted in a patented housing with the motor set in a separate built-in chamber, entirely isolated from the air flow. Thus, the motor remains cool and clean and is completely protected from the fumes and gases which are bypassed around it. The Bifurcator can be installed as an integral part of the duct system without directional change in air flow. The unit is said to offer the advantages of low installation cost, savings in power consumption, space, and weight. DeBothezat Bifurcators are available in sizes from 8 inches to 48 inches, in a wide range of metals and alloys. Copies of the catalog and price lists may be had by writing to American Machine and Metals, Inc., DeBothezat Ventilating Equipment Div., East Moline, Illinois.

NEW! Pulmosan Shield-Respirators



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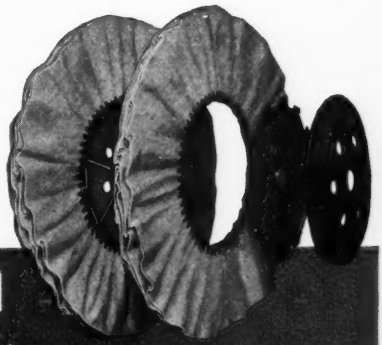
Jackson Buff Corporation of Long Island City, New York, has rights to U. S. Patents Nos. Re 19,894 and 2,140,208 which have broad claims covering an air-cooled buff having means for the admission of air through the sides of the buff. Owner intends to protect all rights and stop infringement.



CORPORATION

LONG ISLAND CITY, N.Y.

BARREL FINISHING OF METAL PRODUCTS

A Discussion of the Mechanics of Barrel Finishing Operations

By H. Leroy Beaver

CONTINUING from the January Issue the discussion of the Barrel Finishing of Metal Products under the above sub heading, we have still another factor in connection with the speed of revolution of burnishing barrels. It has always been assumed when parts to be finished were added to the burnishing mass that they were generally distributed throughout the mass. However, we have noticed in examining a great many barrels, and especially those wood-lined metal barrels wherein stampings are operated either for deburring, cleaning or smoothing the surface prior to electroplating or some other form of finishing, that the wood liners had a tendency to show wear at different parts of the arc of the side liner between the center of the axis of the barrel and the outer periphery of the barrel liner. The wear seemed to indicate that parts carried in suspension in the burnishing mass set their own location in the mass, by what for want of a more expressive term we might call the pitch diameter of the parts traveling through the mass. There is apparently some relation between the centrifugal force developed in a revolving barrel acting along with the resistance of the mass that has a tendency to hold parts at an artificially created diameter of motion. On a high and narrow type of barrel this is apparent. For example, on a barrel 16 in. wide and 30 in. in diameter, if the barrel is operated at 30 r.p.m. the wear on the liner is greater on the side or end liner close to the periphery of the barrel and on the peripheral liner itself, because the side liners are worn at the angle where the side liner meets the peripheral liner. When the speed of the barrel is 24 r.p.m., the greatest wear seems to occur in a distinct band that runs from 6 to 8 inches from the periphery toward the center of the barrel. If the speed is 18 r.p.m., the point of greatest wear on the side liners is brought closer to the center of the axis of the barrel, or substantially as shown in the sketch shown in Fig. 1.

This seems to be borne out by the action observed in the scientifically operated barrel as developed by Uebersax. At this point, the reader should refer to Figure 2 in the paper in the January issue of PRODUCTS

FINISHING where we have previously described placing an article in spaces 7 and 3. After operating the barrel for a considerable period of time, the parts will be found in substantially the same position as first placed in the barrel. For example, the mass may and undoubtedly does change its position due to slippage of the mass, but if the parts were originally placed in spaces 7 and 3, when the barrel is stopped they may be found to have shifted to spaces 1 and 5 or 8 and 4. However, the one part will invariably be diametrically opposite the other, and in the case of a barrel 17 in. in diameter and 24 in. long, the location would be at approximately 2/3 of the distance from the center of the axis of the barrel to the periphery. When large parts such as "hollow ware" are brought into contact with the sides of the barrel a distinct contact of the part against the barrel can be heard. This bumping will readily be detected at an operating speed of 24 r.p.m. but it is entirely absent at a speed of 14 r.p.m. Even further than this, in a barrel of this type distortion is noted at 24 r.p.m., but no distortion is noted when the barrel speed is held at from 14 to 18 r.p.m.

All of the foregoing would seem to substantiate the position we have always held and have so frequently expressed throughout this series, that is, distortion and damage to parts in process is not caused by too great a load of burnishing material in the mass, but almost invariably by excessive barrel speeds which bring on the impingement finishes we have previously discussed.

Now as contrasted with the above, if we examine the wood liner of a typical long and narrow barrel we find that any wear on the liner due to operating burred parts in the barrel is evenly distributed over all parts of the liner. This is undoubtedly due to the fact that the speeds at which this type of barrel is operated are excessive, at least when considered in comparison with the barrel of Uebersax which is operated under the principles of established procedure in mechanics.

Another factor that contributes largely to distortion and damage to parts in process is too light or perhaps we should say too small a load of metallic burnishing materials.

Very few concerns carry any considerable quantity of burnishing materials in stock and only order from time to time a sufficient quantity to bring their barrels up to proper load. That many barrels are operated under load is borne out by the fact that very few orders are placed with makers of steel burnishing materials for lots of less than 50 lbs. and more often for 100 lbs. or more. In a barrel of the small, long and narrow type whose normal load of material

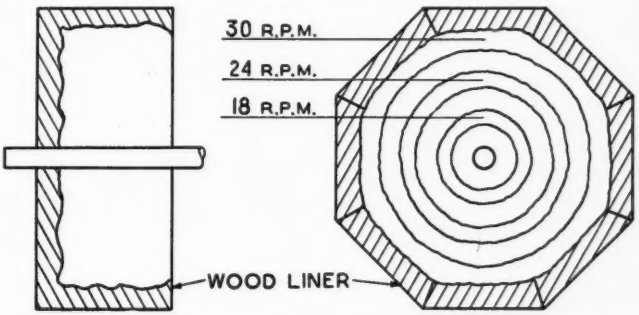


Fig. 1—Drawing illustrating a high and narrow type burnishin barrel with a wood lining. The irregular circles indicate areas of wear on the liner.

for proper operation should be 200 lbs., a deficiency in load of even 50 lbs. may well mean the difference between useful operation and prejudicial operation. On this particular phase, we might note that the last call we had where damage to parts in process was the trouble, we found a 16x30 in. long and narrow type of barrel that should never be operated with a load of less than 450 lbs., being operated with something less than 200 lbs. of burnishing material, but carrying exactly the same quantity of parts for processing as when the barrel was originally installed with its full load of burnishing materials. The solution of the problem was simply to bring the load of burnishing material to full quantity and lower the speed of the barrel. The trouble immediately ceased.

In any underloaded barrel, whether high and narrow or long and narrow, it will be found mechanically impossible to obtain a satisfactory finish whether the purpose of the operation is merely to obtain a superficial polish or burnish, or whether the operation is to obtain the full purpose of a barreling operation, that of cold working surface so as to close the pores for resistance to corrosion or hardening the surface for resistance to wear.

Here may we again stress the importance of using maximum loads of burnishing materials in an adequate barrel, not merely for the purpose of obtaining a brilliant finish which is stressed by most barrel manufacturers as the essential part of the operation, which of course it definitely is not, but rather for the more important functions of the operation for closing porous surfaces and hardening such surfaces as well.

We defer to no one in the metal finishing field in the measure of our admiration and respect for the tremendous progress made by our electrochemists in the solution of so very many of the intricate and difficult problems relating to the electrodeposition of various metals on base materials, and especially to the many noted men both here and abroad laboring on a multitude of problems in both the British Electroplaters' Society and the American Electroplaters' Society, and particularly in the work of the Research Committee of the latter. Yet with all the magnitude of their work, the problem of porosity of plated surfaces still persists as a major problem. There is no end to records of cases where porosity is present at from .001 in. to .0025 in. of plated thickness and where by increasing the thickness of the plate to .0025 in. to .005 in. the surface will show negative to corrosion with salt spray test. We have suggested that the mechanics of barreling operations might well be profitably considered in connection with the porosity problem. There are many cases where porosity shown at a plated thickness of .001 in. will completely disappear with an appropriate barreling operation where otherwise it could not be overcome except by building up the thickness of the plate to .0025 in. to .003 in. The difference in cost of additional metal for deposition as well as time consumed in depositing the plate so often warrants a less expensive barreling operation that it is surprising that barreling operations generally are not more widely used in all of our industries wherever the process is applicable.

Authorities tell us that the number of pores in a plated surface will vary on an average for all plated parts of from 32 pores to 340 pores per decimeter square of surface (15.5 square inches). This would be equivalent to a square of the dimension of 3.937 or less than 4 inches. We can

form some more visual idea of the extent of such porosity by simply drawing an outline of two 4 in. square on a piece of paper, and then with a pencil put 32 dots in the one square and 340 dots in the other which would represent the average minimum and maximum of porosity of a plated surface. If the purpose of an electroplating operation was merely to enhance the appearance of a part then porosity would not be such an important factor, but inasmuch as plating is pretty generally for the purpose of covering a base metal with a more valuable metal that has corrosion resistant properties not possessed by the base metal, then it becomes most important to utilize every possible means to cure the deficiency of a plated porous surface so that such a plated surface might definitely and more positively serve the purpose for which it was intended.

In all of our investigation of the subject if we were asked to state what we considered the most important function of a barreling operation we would immediately pass over the superficiality of a brilliant surface finish, which could be obtained in most any size or type of barrel, in favor of the more important and essential thing—the cold working factor of the barreling operation that closes the pores for resistance to corrosion and at the same time hardens the surface for resistance to wear.

It must be understood, and we wish to do all that we can to correct a widely prevalent notion held by so many people, that these important functions of a barreling operation are almost instantaneously performed in any type of barrel. This, of course, is not true, much as we wish that it might be, because at times quite long operating cycles are required to ob-

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tain the desired finishes. In some barrels of light load, sufficient pressure cannot be developed to vary the degree of plasticity of a plated surface irrespective of the length of time of operation. After all, a certain amount of pressure is required and this pressure is dependent on the weight of load rather than on the element of speed, and must be adequate. The theory of "a small barrel for small lots of parts" and "a large barrel for larger production lots" is pure fallacious reasoning, because if the pressure required be 1000 lbs., then that pressure will be necessary whether the load be one or one hundred or one thousand parts operated upon at one loading.

We are asked whether the same loads of materials were required for all plated surfaces irrespective of the type of metal deposited. This question could possibly be best answered by showing the Brinell Hardness of the various metals more widely used in electro plating procedure, as follows:

	Per cent Hardness
TIN	20
ZINC	50
CADMIUM	50
SILVER	130
COPPER	300
IRON	350
NICKEL	560
RHODIUM	650
CHROMIUM	950

It will thus be seen that as the hardness of the various plated metals increases, proportionately heavier loads of burnishing materials are required for the proper performance of the barreling functions. It will be noted that a barrel of small size and light load might function satisfactorily on tin, zinc, cadmium and silver, but its real effectiveness would probably end with silver, and beyond that point nothing would be gained except a superficial finish we have previously noted.

If a part after plating and test shows too porous a surface, then the operation must be considered to be inadequate and the result superficial. In a burnishing or barreling operation, if the type of barrel and load of burnishing material in the mass can only be made to produce a lustrous finish but the plated surface still show positive to corrosion tests, then too, the barreling operation must be considered inadequate and the result superficial. Obviously, the ultimate purpose of this research is to supplement electroplating results that have resisted electrochemical solution by an easily applied yet simple and efficient mechanical procedure.

May we say very definitely that we hold no brief for any barrel manufacturer or manufacturers whoever they may be or wherever located. Our research on the subject is purely an independent personal procedure. We are not interested in the maker or the kind of barrel you buy, but we are interested in setting down our best approximation of the action of the various type of barrels, to the end that when you do install a barrel or barrels that such an installation will be adequate for carrying out on your production the essentials of the various barreling operations.

We are indebted to Mr. George B. Hogaboom for his suggestion that we discuss the importance of results in barreling operations secured by continuous pressure as distinguished from impingement.

Metals and Alloys Bulletin No. 76. The Cambridge Wire Cloth Company, Cambridge, Md., is now publishing a bulletin on metals and alloys designated as No. 76. According to the company, the purpose of the bulletin is to present in con-

cise form some of the fundamental information concerning alloys.

Described in the bulletin are Cambridge wire cloth, wire screens, spiral woven wire conveyor belts, metallic filter cloth, wire trays and baskets. These items can be furnished in any metal or alloy that is drawn to wire form.

A copy of Bulletin No. 76 will be sent free upon request.

Ivanhoe Super-Lite. A catalog which illustrates and describes the Ivanhoe line of fluorescent lighting fixtures is now being issued by The Miller Company, Meriden, Conn. The Miller Company is now offering a two-light fluorescent fixture for general illumination of industrial areas.

The Super-Lite fixtures are designed especially for general illumination for mounting 9 to 12 feet above the floor.

The Super-Lites are of open-end construction and utilize a Tulamp ballast with a starting compensator which has a high power factor. This feature is said to provide a better regulation of voltage and minimizes strobscopic effect. The units are constructed of porcelain-enameled steel.

Copy free upon request.

National Paint Dictionary. One of the most complete books of its kind ever to be published designated as "The National Paint Dictionary" by Jeffrey R. Stewart, is now being published by Chemical Publishing Co., 148 Lafayette St., New York, N. Y. There are almost 200 pages and 200 illustrations including definitions of trade names of raw materials used in the paint and allied industries in this book.

The National Paint Dictionary includes charts, tables, useful information, and miscellaneous data. Important testing devices and apparatus used in the laboratory, together with illustrations, are described.

The book is bound in blue Fabrikoid, trimmed with green and gold stampings. The book is strictly technical, thoroughly authentic, and completely unbiased.

This book is available at $5.00 per copy. Copies are available by writing to Chemical Publishing Co., 148 Lafayette St., New York, New York.

Mention PRODUCTS FINISHING when writing to advertisers. Your cooperation will be appreciated both by the advertiser and this magazine.

Did You Know That---

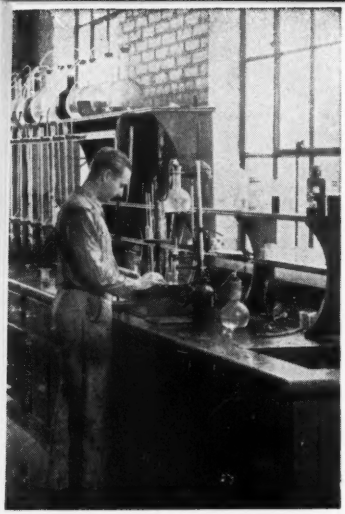
—Nickel deposited from a nickel chloride-boric acid solution is finer grained, smoother, harder, stronger, and somewhat less ductile than soft deposits from an ordinary sulphate electrolyte? See page 9.

—An effective method of cleaning zinc base die castings before plating operations is now available? See page 21.

—Attractively finished products encourage sales? See page 22.

—A bulletin describing dust control systems is being mailed free to those who request it on their firm letterheads? See page 31.

—All the formulas on metal coloring appearing in "Metal Coloring Theory and Practice" have been thoroughly tested for accuracy and results? See page 32.



THE Finishing FORUM

Accelerated Service Tests for Finishing Materials

THE need quite frequently arises in the finishing department for a simple and accurate method of testing a finishing material in order that comparisons may be made before the material is applied. In recognition of this need, a number of practical tests have been gathered together and, beginning with this issue, several will be presented each month.

Inasmuch as many of the readers of PRODUCTS FINISHING will want to preserve these tests for future reference, several suggestions are made herewith as a guide.

The page opposite has been printed especially for use as a cover for this series. The reverse of the cover page carries an index of the complete series of tests. The tests that appear as No. 1 and 2 are printed on a special page which can easily be removed if cut on the dotted line. Hole marks are also designated on this page, the distance between the holes being such that when punched out, the page will fit into a standard size 8½ x 6 in. three-hole looseleaf notebook. If no ring binder is available, the sheets can be bound together with brass paper staples.

Do you have a metal finishing problem?

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If there is a "kink" or short cut in use in your shop, send in a description of it. . . . Each one published will be paid for.

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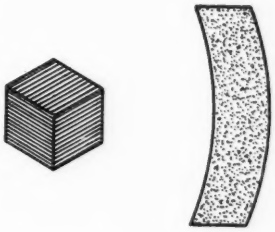
No. 1 Abrasion Test

Determination of the resistance of an organic finish to abrasion.

APPARATUS: Felt faced steel cube three inches square, emery paper.

PROCEDURE: After aging for twenty-four hours, fix the panel securely on a solid horizontal base. Wrap a three by eleven inch emery paper around the block, holding it in place over the felt pad with a heavy rubber band. Place the block on the finish and with a steady motion, rub back and forth in a straight line over a distance of three inches. Allow the emery paper to cut away the finish under the pressure of the weight of the block. The size of block and grade of emery paper may be varied to suit particular requirements.



CONCLUSIONS: The number of strokes necessary to bare the metal is a measure of the resistance of the finish to abrasion.

No. 2 Adhesion Test

Determination of the adhesion of an organic finish.

APPARATUS: Straight edge, sharp knife, thermometer, putty.

PROCEDURE: Age the panel twenty-four hours and bring it to seventy degrees Fahrenheit, measuring the temperature by means of the thermometer stuck to the panel with a lump of putty. Using the straight edge, make a number of parallel cuts one thirty-second of an inch apart through the finish to the base metal. Make another set of cuts at right angles over the first. Scrape the cut section lightly with the knife blade until it is smooth. The aging period and the temperature may be varied to suit particular requirements.

CONCLUSIONS: The number of squares which flake off per square inch is a measure of the adhesion of the finish.

No. 3 Bend Test

Determination of the resistance of an organic finish to bending.

APPARATUS: One-half inch diameter steel mandrel, thermometer, putty.

PROCEDURE: Age the panel twenty-four hours and bring it to seventy degrees Fahrenheit, measuring the temperature by means of the thermometer stuck to the back of the panel with a lump of putty. Remove the thermometer and bend the panel through ninety degrees over the mandrel by applying a steady pressure at the ends of the panel. The mandrel diameter, angle of bend, aging period and temperature may be varied to suit particular requirements.

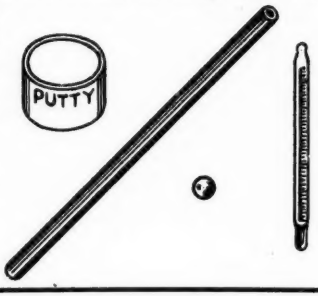
CONCLUSIONS: Examine the finish at the bend for the degree of chipping, cracking or peeling.

No. 4 Impact Test

Determination of the resistance of an organic finish to impact, sharp blows, and so on.

APPARATUS: One-inch diameter steel ball, three feet of standard one-inch pipe, thermometer, putty.

PROCEDURE: Age the panel twenty-four hours. Place the panel on a solid base inclined at forty-five degrees. Fix the pipe vertically with its lower end two inches above the panel. Continue to drop the steel ball through the pipe until the finish cracks or chips, or if the paint is soft, until the bare metal shows through. Maintain the panel at seventy degrees Fahrenheit during the test, measuring the temperature by means of the thermometer stuck to the panel with a lump of putty. The steel ball, height of fall, aging period and temperature may be varied to suit particular requirements.



CONCLUSIONS: The number of drops necessary to cause failure of the finish is a measure of the resistance to impact.

Polishing the Mainliner is an important finishing operation between overhaul periods at the Cheyenne shops of United Air Lines.

CLEANING THE MAINLINER

THE cleaning of an airplane might seem to be comparatively as simple as washing an automobile with the exception of a larger area to be covered. Mere washing, however, is not sufficient to produce the brilliant lustre of the twin-engined, 21-passenger Mainliner that whisks its way through the skies at three miles a minute on United Air Lines' coast-to-coast and Pacific Coast airways.

When a Mainliner is taken into United's central maintenance base in Cheyenne, Wyoming, for a periodic engine and plane overhaul, the exterior covering of the fuselage is cleaned, scrubbed, waxed, and polished. The wax surfacing will remain until the next overhaul period if it is not removed by a strong cleaning solution. During the time between overhaul periods, dirt, water spots, grease and oil film accumulate on the surface and must be removed in order to keep the Mainliner looking spick and span in service.

Mild cleaners containing a wax base are used to remove the water spots, grease, and oil film. A hand massaging process is employed and only soft cloths can be used. Since the cleaners cannot be permitted to dry on the surface, the cleaning of a Mainliner is not an overall job accomplished with a minimum of effort. One section of surface approximately four to six feet is taken at a time. Once the surface of the Mainliner is thoroughly cleaned, the final operation is relatively simple. The surface is polished with soft cloths until it gleams like a mirror.

Wrap-Rax Tape Bulletin WR-101. A bulletin describing Wrap-Rax Tape, a covering for electroplating racks, is now being issued by Hanson-Van Winkle-Munning Co., Matawan, N. J. Wrap-Rax Tape is said to be a synthetic thermoplastic resin in tape form, resistant to cleaning, pickling, and plating solutions commonly used, including chromium and bright nickel. The cover is said to contain no elements which might contaminate the solution.

Copy free upon request.

News OF THE INDUSTRY

Hilo at International Heating and Ventilating Exposition

Hilo Varnish Corporation, 42-60 Stewart Ave., Brooklyn, N. Y., was one of the many exhibitors at the Sixth International Heating and Ventilating Exposition held at Lakeside Hall, Cleveland, Ohio, January 22 to 26, inclusive.

A wide variety of Hilo protective and decorative finishes, as used throughout the industrial field, were on display. One of the feature finishes exhibited was the new spatter finish which was added recently to the line of Hilo industrial finishes.

Detroit Rex Announces Promotions

W. W. Davidson, vice-president in charge of sales, Detroit Rex Products Company, 13017 Hillview Ave., Detroit, Mich., has announced the following promotions.

H. R. Norgren has been made assistant general sales manager in charge of special accounts: D. E. Williard, assistant general sales manager in charge of regions and branch offices; and R. A. O'Reilly, manager of dry cleaning division.

Jones-Dabney Expands

Jones-Dabney Company, Industrial Division of Devoe & Reynolds Company and Wadsworth, Howland and Company, has announced the removal of offices for the Eastern Division to its present eastern manufacturing plant in Malden, Mass. Last fall, Jones-Dabney set up an industrial manufacturing unit in Malden for its eastern trade. The company then transferred Mr. J. M. Creager from Louisville to take charge of manufacturing. He had been assistant production manager in Louisville and now continues to take charge of production in Malden.

To better serve the eastern trade, which includes New England and the Atlantic Seaboard, the company is now moving the sales offices to Malden. This makes the Eastern Division complete. Mr. George A. Litchfield, who has been divisional sales manager at the Louisville Division, is being transferred to Malden as manager.

The Jones-Dabney Company reports a substantial increase in sales over the same period last year. This increase is due to the acquisition of several new industrial accounts as well as resin accounts. Regular accounts are somewhat ahead of last year which also is a good indication of improved business conditions.

James H. Gravell Passes

James Harvey Gravell, president of American Chemical Paint Company, Box 303, Ambler, Pa., passed away at his home Friday, December 8, 1939. It is with deep regret that the industry has witnessed the passing of this well known figure.

Director of Sales of Corronizing Division of Standard Steel Spring Company Appointed

Mr. R. C. Enos, president of Standard Steel Spring Company, Coraopolis, Pa., announces the appointment of

Thomas N. Berlage as director of sales for the Corronizing Division of the company. Corronizing is a process for coating steel for corrosion protection.

Mr. Berlage will assume his new duties with a rich background of sales experience with several prominent concerns.

Mr. Berlage is a graduate of the Massachusetts Institute of Technology where he earned the degree of Bachelor of Science in Chemical Engineering. He is 38 years of age.

New office and factory now occupied by E. Reed Burns Manufacturing Corporation

E. Reed Burns Occupies New Office and Factory

The beginning of the present E. Reed Burns organization goes back to the year 1888. In that year, Mr. E. Reed Burns opened on Water Street in Manhattan a small shop to make Crocus and White Finish for the stove trade to whom he had been selling sheet mica for several years.

The business grew rapidly and four years later he purchased land at 40-42 Withers St., Brooklyn, N. Y., and erected a three story building. By this time the products of the new company included all types of buffing compositions as well as polishing wheels and buffs. Until the early twenties a general supply business was carried on including the sales and servicing of generators and plating installations. During the early 1900's additional property was bought on Jackson Street, running from 21 to 27 and on this a three story building was erected.

These two buildings, one on Withers Street and one adjoining on Jackson Street, served as the home office and plant until 1937, when through a condemnation proceeding of the City of New York for a new cross city boulevard, the major part of the Jackson Street property was taken. The result was that the entire plant was reconstructed, the three story building on Withers Street being replaced by a modern brick building containing the offices, manufacturing, shipping and receiving departments and buff and polishing wheel department. Along the new boulevard, 227-239 Meeker Avenue, an extension was built consisting of a modern building adapted for efficient, economical, straight line production.

Before Mr. Burns, Sr. died in 1928, he saw his three sons become active in the business. They carry on the enterprise today: Russell H. Burns, president; Herbert R. Burns, treasurer, and Lloyd S. Burns, secretary.

Today, the production of the company is centered exclusively on buffing compositions, buffs and polishing wheels producing a quality which has stood the test for more than 50 years.

Sales representatives are located in the following cities: New Haven, Conn.; Buffalo, N. Y.; Pittsburgh, Pa.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; and Beloit, Wisconsin.

A number of employees have been continuously with the company for upward of 25 years.

New Licensees for New Wrinkle, Inc.

New Wrinkle, Inc., Mutual Home Bldg., Dayton, Ohio, licensors of wrinkle finishes, has recently appointed the following licensees for the manufacture and sale of wrinkle finishes: John H. Witte & Sons, Burlington, Iowa; St. Louis Surface & Paint Co., St. Louis, Mo.; and Standard Paint & Varnish Co., Windsor, Ontario, Canada.

A. C. Horn Company, Long Island City, N. Y., is extending its wrinkle finish activities to include its plants in Boston, Chicago, Dallas, Houston, San Antonio, New Orleans, and San Francisco.

Maas & Waldstein Company, Newark,

N. J., is extending its activities on wrinkle finishes to its other plants located in Chicago and Los Angeles.

The increased popularity of wrinkle finishes as a means of "dressing up" consumer, industrial and commercial products is further augmented by its economy in application and by the fact that wrinkle finishes are now available from coast to coast through a widely spread network of well equipped and well informed licensees.

Walter Kidde & Company Plans New Building

Ground was broken recently for the erection of a new engineering building for Walter Kidde & Company, makers of carbon dioxide fire extinguishing equipment, to be located on the Company's manufacturing site at 1031 West St., Bloomfield, N. J. The new structure, to be devoted exclusively to engineering and research work, will add 20,000 sq. ft. to the Company's working space, and will house a large staff of engineers when completed.

Designed by J. Floyd Yewell, New York architect, and to be built by Walter Kidde Constructors, Inc., an affiliated company, the new building is of reinforced concrete construction, three stories in height, and rests on concrete pile foundation. It is distinguished for its liberal use of glass brick-faced walls. Construction will be completed by April 30, 1940.

Unusual features of the new building include two fireproof record vaults, which are protected by built-in automatic carbon dioxide fire extinguishing systems. Also, each floor will be protected by portable carbon dioxide fire extinguishing units. The Kidde firm specializes in these devices, which smother flames with gas instead of water, and are used to prevent water and chemical damage to engineering drawings in event of fire in drafting rooms or record vaults.

Thomas Appointed Ohio Representative of Roxalin

According to an announcement made recently by the Roxalin Flexible Lacquer Company, 800 Magnolia Ave., Elizabeth, N. J., Mr. Frank C. Thomas will now represent this company in the Ohio territory.

Mr. Thomas has had a thorough schooling in the Roxalin plant and laboratory and for the past three years has represented the company in Connecticut.

Changes in Carborundum Company

Charles Knupfer, vice-president, The Carborundum Company, Niagara Falls, N. Y., announces the transfer of Mr. H. W. Collinson, who for many years has been district sales manager in the Cleveland industrial territory, to the position of district sales manager of The Carborundum Company at Chicago, Ill. Mr. Collinson takes over the Chicago post formerly held by Mr. F. E. Gridley, who has been granted an extended leave of absence.

To succeed Mr. Collinson at Cleveland, announcement is also made of the appointment of Mr. E. F. Konker as district sales manager. Mr. Konker was formerly a member of the Carborundum sales staff.

The territory vacated by Mr. Konker will now be covered by Mr. K. C. Woltz, previously a member of The Carborundum Company sales engineering staff.

Vander Voort Joins Hanson-Van Winkle-Munning Company

According to a recent announcement, Jack Vander Voort, former eastern representative of PRODUCTS FINISHING, has joined the Hanson-Van Winkle-Munning Company, Matawan, N. J., as sales representative. In his new capacity, Mr. Vander Voort will represent the Hanson-Van Winkle-Munning Company in its line of electroplating and polishing equipment and supplies. The friends of Mr. Vander Voort extend their sincere wishes for success in his new work.

Joseph B. Kushner Moves Consultant Office

Joseph B. Kushner, Ch.E., well-known electroplating engineer and consultant, has moved his office and laboratory from 20 Eldridge St., New York City, to 192 Broadway, New York City. The new quarters have much larger laboratory space and facilities and will enable him to give better service to his clients in the plating industry. The change in address was made necessary by the rapid growth of his "Personalized Plating Service." This service,

which enables the manufacturer and job shop to get person-to-person advice and help with their plating problems, has proved so popular with his clients that Mr. Kushner has been obliged to take more space to provide for increased laboratory equipment, and experimental and practical plating apparatus.

United Chromium Inc. Wins Suit

The trial before Judge John P. Barnes in the Federal District Court, Northern District of Illinois, Eastern Division, in the suit brought by United Chromium, Incorporated against Great Lakes Plating & Japanning Co. for infringement of the Fink Patents, U. S. Patents Nos. 1,581,188 and 1,802,463, covering methods of commercial chromium plating, was completed the latter part of November, 1939.

In a decision, of which the transcript was filed of record on November 29, 1939, both patents in suit were held valid, and Claims, 4, 6, 10, 13 and 18 of U. S. Patent No. 1,581,188, and Claims 1, 2, 3 and 4 of U. S. Patent No. 1,802,463, were held infringed.

An Interlocutory Decree was entered on December 27, 1939.

The Court in referring to U. S. Patent No. 1,581,188 concluded that the Sargent Article did not anticipate disclosures of this patent; further holding that the evidence introduced in the case did not show that Udy ever operated a chromium plating bath by the methods stated in Fink's claims prior to Fink, and also referred to other alleged defenses which had been cited.

The Court held that neither Haring, Udy or Pfanhauser anticipated Fink Patent No. 1,802,463.

Bertrand Joins Sheffler-Gross Co. As Sales Engineer

According to a recent announcement made by Sheffler-Gross Company, Drexel Bldg., Philadelphia, Pa., Mr. George F. Bertrand has been added to the organization as sales engineer. Mr. Bertrand has had over 15 years of experience with a nationally known air conditioning corporation. During this time, he was engaged in design, construction, and testing of air conditioning systems for industrial and comfort applications. According to the announcement, he will specialize in the sale of air conditioning devices sold by Sheffler-Gross Company.

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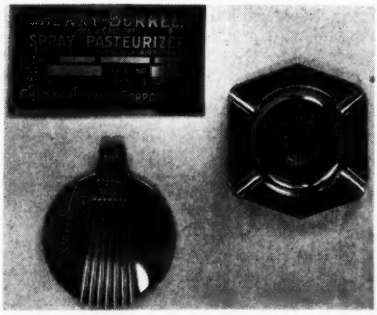
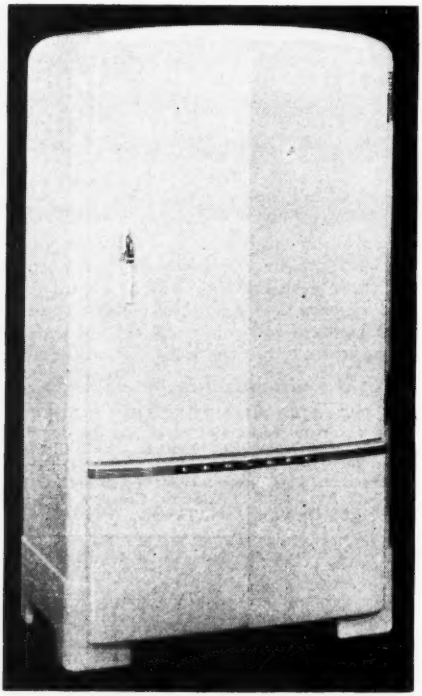
Finishes THAT AID IN APPEARANCE AND UTILITY

(Right) — Attractive name plates and souvenir ash tray fabricated from prefinished nickel and chrome plated aluminum sheets.

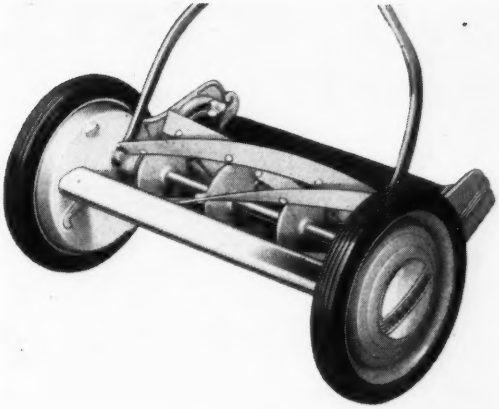


(Photo Courtesy American Nickeloid Company)

(Photo Courtesy Nash-Kelvinator Corporation)



(Left)—Leonard refrigerator cabinets are ruggedly built of heavy, rust-proofed steel, welded and sealed at all joints to keep out outside air and moisture and finished in Permalain white finish. The bottom shelf of the cabinet is finished with acid-resisting porcelain enamel on steel.

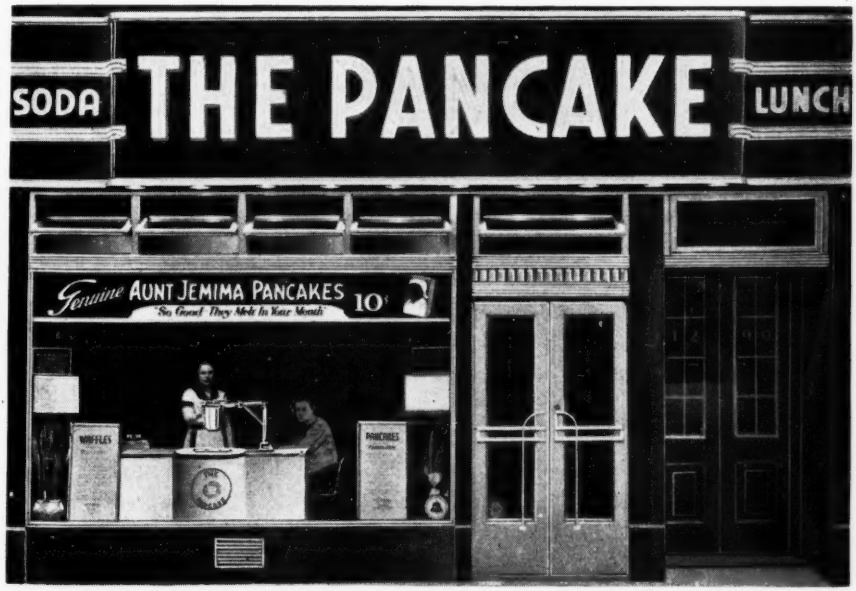


(Right) — This 1940 model "Marathon" lawnmower is smartly styled and constructed. The handle is chromium plated tubular steel. The hub caps are chromium plated stampings of the snap-on type with the letters of the name debossed and painted red for contrast.

(Photo Courtesy Designers for Industry)

(Below)—Illustration showing installation of a highly efficient, compact, and attractive pancake machine. The entire top of the unit is of heavy gauge stainless steel and the body is finished with ivory porcelain enamel.

(Photo Courtesy American Rolling Mill Co.)



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January 5, 1940

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Attention of Fred W. Vogel, Managing Editor

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Actually, we received over fifty inquiries from well rated concerns, from which we have obtained over a dozen orders and will probably close quite a few more in the ensuing months.

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You'll find it profitable to schedule a series of advertisements in this magazine starting with the March issue. Send copy now. Forms close February 15th.

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New PLANT EQUIPMENT AND Materials

Excelsior Stainless Steel Sheet Polishing Machine

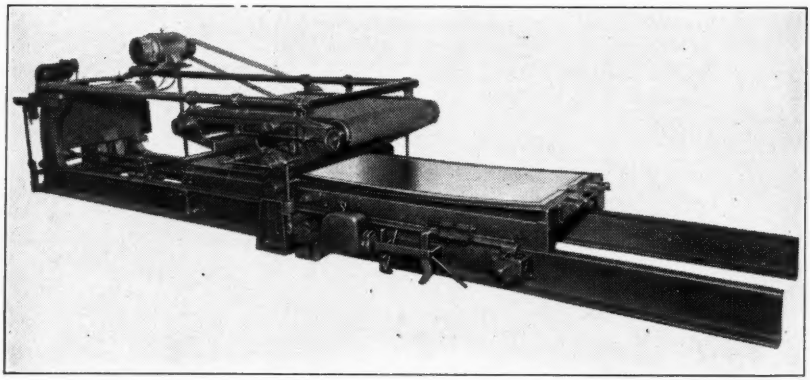
The Excelsior Tool & Machine Co., East St. Louis, Ill., has designed and is now marketing a stainless steel sheet polishing machine to be known as the "No. 27-H." This machine can be installed by stainless steel equipment manufacturers to polish sheets to any required finish for a job in process. Stainless steel sheets can be polished by the Excelsior method to a No. 4 finish.

All the adjustments of the Excelsior No. 27-H Stainless Steel Sheet Polishing Machine are mechanically controlled and adjusted at one location. According to the manufacturer, four to 20 sheets of any gauge up to 4 ft. wide by 12 ft. long can be polished in one hour by two men.

The grinding belts of the unit can be removed and replaced within five minutes and are said to require no further adjustment after they have been centrally located on the drums.

A positive clamping attachment for the sheets and adjustable travel for the carriage are said to prevent any possible damage to the polishing belts or the rubber-covered contact pressure drum.

The pressure on the grinding belts, which varies from 200 to 600 lbs., is applied by a gravity pressure principle and is regulated by removable hand weights. This method is said to assure positive regulated pressure contact over



Excelsior Stainless Steel Sheet Polishing Machine

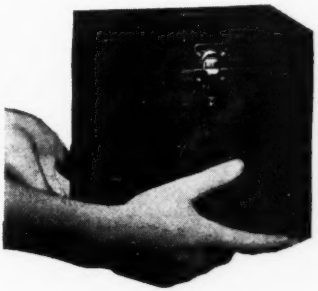
the entire width and length of the sheet being polished. A 30 h.p. motor operates the polishing belts at 3,500 lineal feet per minute. A separate 2 h.p. geared motor is used to reciprocate the table at 60 feet per minute. Commercial paper grinding belts up to 50 in. wide by 16 ft. are recommended. Commercial belts with No. 120 and 150 grain abrasive will polish a No. 2-B milled sheet to a No. 4 finish.

The drums of the No. 27-H Stainless Steel Sheet Polishing Machine are diametrically balanced and revolve in oversize dustproof ball bearings that are mounted in rigid cast steel housing. There are no metallic connections between the polishing head and the carriage, thus vibration of the sheets to be polished is eliminated.

Cameron One-Two pH Tester

A pH tester which is a self-contained instrument designed for the plant or laboratory where reading accuracy may be a tenth pH unit, to be known as the "Cameron One-Two" has been placed on the market by Wilkens-Anderson Co., 111 N. Canal St., Chicago, Ill. This unit makes use of the Cameron Red Bulb Glass Electrode which is available filled and sealed, ready for use.

A Calomel Electrode, ready for use with addition of potassium chloride



Cameron One-Two pH Tester

solution supplied, is available with this testing unit. A single tube amplifier is built in and dry batteries are of stock manufacture. The instrument is housed in a beautiful walnut cabinet and weighs

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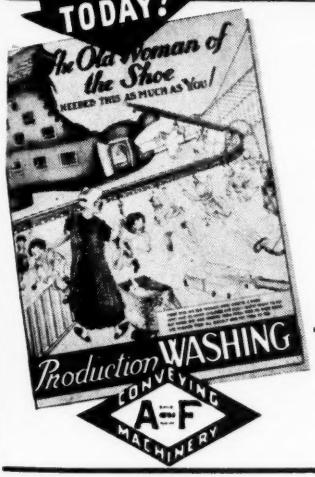

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but ten pounds. The scale of the Cameron One-Two pH Tester reads directly over the generally accepted glass electrode range of 1 to 11 pH. This may be shifted, when calibrated, to 0 to 10 pH or 12 pH range when required by the operator.

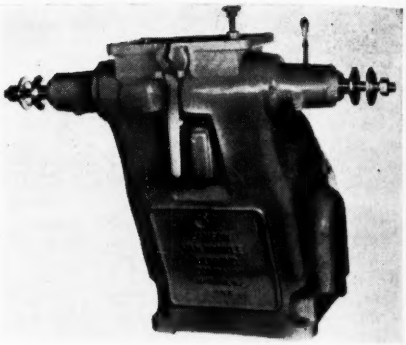
Hanson-Van Winkle Munning Type MI Buffing and Polishing Lathe

A buffing and polishing lathe designated as the "Type MI" has been placed on the market by Hanson-Van Winkle-Munning Co., Matawan, New Jersey.

The Type MI Buffing and Polishing Lathe is said to be a compact unit of rugged construction and is designed to eliminate vibration, assure smooth performance, and long life. The spindle of the unit turns on ball bearings which are of oversize capacity, precision made and precision mounted, and lubricated by an oil reservoir. The spindle drive is through heavy duty high speed V-belts and accurately machined sheaves. A sturdy spindle lock is provided. The lathe has a 12-in. overhang of the spindle to provide clearance for work.

The method of changing V-belts on the Type MI Buffing and Polishing Lathe is said to be new and simple. By loosening a few bolts, the change can be quickly made without disturbing spindle bearings or alignment. Any spindle speed within the range of 1,800 to 3,600 r.p.m. can be obtained. Other speeds are available by changing the motor sheave pulley. The V-belt tension can be adjusted by a handwheel located at the rear.

The motor is continuous duty N.E.M.A. standard, ball bearing equipped and protected by a magnetic starter. Bronze spindle nuts reduce wear on the flat top



Hanson-Van Winkle-Munning Type MI Buffing and Polishing Lathe

spindle threads. Spindle flanges are of heavy cast iron, machined all over. Both ends of the spindle are tapped for taper points.

A tray is included for composition and tools. A wrench hook is provided. A start-stop lever is included for starting and stopping of motor by means of a switch operating through the starter. A spindle brake, automotive type, is furnished as part of this equipment to bring the spindle to a quick stop in order to change wheels.

Base dimensions on all sizes are 26 in. wide x 24 in. deep. Sizes are 3, 5, 7½, and 10 h.p. Weights are from 1,265 to 1,540 lbs. The lathe is furnished for 220, 440 and 550 volts, 2 or 3 phase, 60 cycle A.C. power circuit; also supplied special for other A.C. or D.C. circuit.

Trojan Nickel Dip Wetting Agent

A surface active material to be known as "Trojan Nickel Dip Wetting Agent" has been placed on the market by Tro-

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DUCTILITY and ATTRACTIVENESS
in your electrodeposits are easy to obtain when you use Harshaw Qualtiy Anodes and Chemicals . . . Try them.
THE HARSHAW CHEMICAL CO.
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jan Products & Manufacturing Co., 3130-36 S. Wabash Ave., Chicago, Ill. This material has been formulated for specific use with the standard nickel dips that are in use in many enamel plants.

Trojan Nickel Dip Wetting Agent is recommended for use in high production systems and where quality and adherence of a nickel coating is desired. Trojan Nickel Dip Wetting Agent provides the means for obtaining a refined grain structure of the nickel coating and thus a better bond to the base metal. Deposition is said to be more rapid and uniform owing to the increased wetting power of the bath. The high wetting power further enables the more uniform deposition in recessed areas and seams.

By the use of Trojan Nickel Dip Wetting Agent, the bath is said to be stabilized against sludging or scum formation as the dispersing properties of the bath are greatly increased. The incorporation of the wetting agent also has a stabilizing effect on the metallic constituents of the bath and buffers the pH to a more constant degree, thus allowing control of the bath and a wider range of uniform performance.

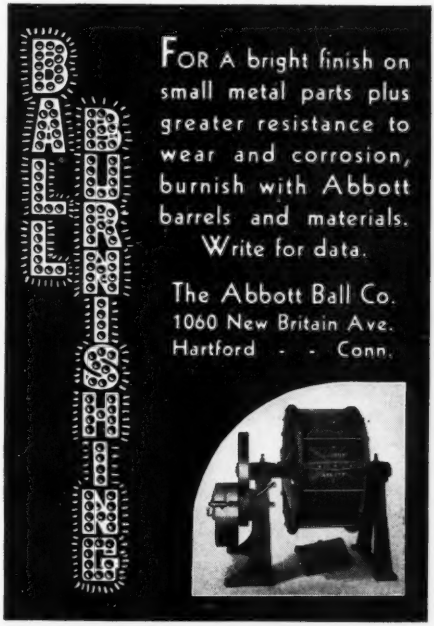
The Trojan Nickel Dip Wetting Agent is said to be a powerful surface tension depressant. A 0.12 per cent solution of Nickel Dip Wetting Agent (one lb. per 100 gallons) is recommended for use in conjunction with any standard formula of nickel dip. According to the marketers, the solution yields identical results in both automatic and batch cleaning-pickling systems regardless of the cycle.

New Roche "DS" Portable Painting Unit

A single diaphragm compressor to be known as the New Roche "DS" is now being marketed by Binks Manufacturing Company, 3114-40 Carroll Ave., Chicago, Ill. This unit is designed for spraying all kinds of average viscosity paints, enamel, lacquer, varnish and so on.

The New Roche "DS" Spray Gun delivers 2.2 c.f.m. actual air delivery at 26 lbs. working pressure. The unit is compact.

The pulsating chamber of the New Roche "DS" is one piece with compressor head. The sturdy special composition rubber diaphragm is said to give


FOR A bright finish on small metal parts plus greater resistance to wear and corrosion, burnish with Abbott barrels and materials. Write for data.
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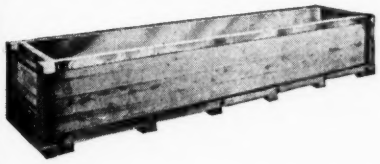

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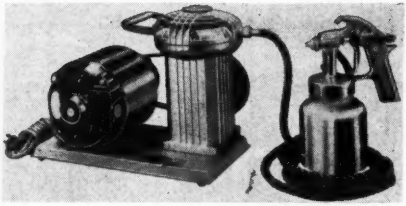


New Roche "DS" Portable Painting Unit

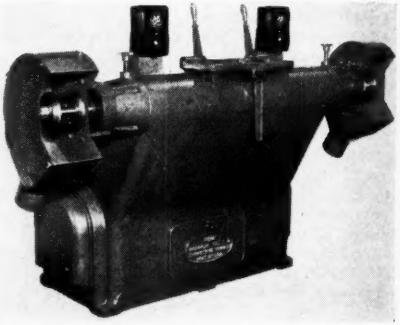
many hours of life under hard usage. The sealed crankcase is prelubricated for the life of the compressor.

The New Roche "DS" Painting Unit comes complete with a Roche "J" internal atomization bleeder type adjustable spray gun and quart pressure cup. The gun is equipped with a flat spray nozzle and with a moisture filter. The unit also includes 12 feet of ¼ in. braided hose and connections, 2 V-pulleys with V-belt and handy carrying handle.

Rome Model "2MIS" Polishing and Buffing Lathe

Rome Machinery Sales & Engineering Co., 627 Webster St., Rome, N. Y., has placed on the market a polishing and buffing lathe to be known as the Model "2MIS." This model, complete with dust hoods and wheel guards, is shown in the accompanying illustration. The Model "2MIS" is arranged for independent wheel operation and is equipped with two spindles, each driven by an individual motor. The unit is available with motors up to 10 h.p. capacity per each wheel spindle. Standard optional equipment includes taper screw points, variable speed wheel drives, composition applicators, high speed auxiliary wheel spindles, and abrasive belt grinding attachments.

The spindle ends are tapered for taper



Rome Model "2MIS" Polishing and Buffing Lathe

point screws. The wheel spindles are made of SAE alloy steel, accurately ground and balanced.

Heavy duty, precision ball bearings are effectively sealed against the entrance of abrasive dust and leakage of lubricant. Bronze spindle nuts, fitted to flat top threads, and spindle locks on

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RUST-I-CIDE "50"

Cleans, etches, and prepares metal for a perfect finishing job.
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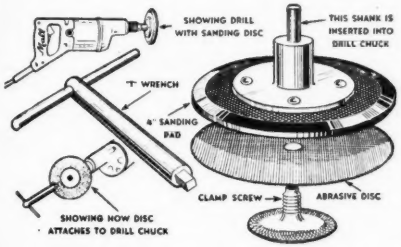
each wheel spindle assist in mounting and removing wheels. The motors mounted within the lathe base are of ball bearing, continuous duty type and mounted on automatic controlled tension bases which are said to provide increased V-belt life and uniform operating tension.

A convenient tool shelf incorporates an accessible spindle nut wrench and wrench hook. Each spindle is individually lever operated with automotive type brake for stopping wheel spindle preparatory to changing wheels. The motors are controlled by start-stop push button switch.

The overhanging base of the Rome Model "2MIS" Polishing and Buffing Lathe provides sufficient foot room for operators. Removable base doors in the ends and front permit access to the motors within the base.

Mall Sanding Pad for Portable Power Tools

The sanding, rubbing, polishing, and buffing pad shown in the illustration is now being marketed by Mall Tool Company, 7740 S. Chicago Ave., Chicago, Ill., for use on all makes of portable power tools and flexible shaft machines. This sanding pad is said to be ideal for doing occasional sanding jobs where the amount of work does not warrant a standard sanding machine.

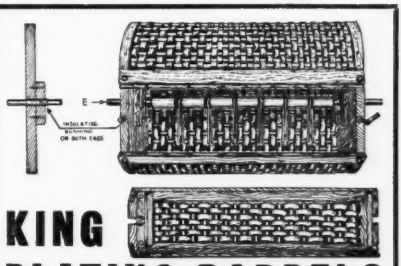

SHOWING DRILL WITH SANDING DISC
THIS SHANK IS INSERTED INTO DRILL CHUCK
"T" WRENCH
4" SANDING PAD
CLAMP SCREW
ABRASIVE DISC
SHOWING HOW DISC ATTACHES TO DRILL CHUCK

Mall Sanding Pad for Portable Power Tools

The equipment consists of a four-inch sanding pad, one abrasive, a clamp screw to hold the abrasive and pad in place, and a "T" wrench to remove or fasten the pad and abrasive. The shank of the sanding pad can be inserted into the drill chuck and tightened in the same manner as a drill bit.

Isodine-Davis

A non-alcoholic solution of iodine for first-aid use to be known as "Isodine-Davis" is now being marketed by Davis Emergency Equipment Company, 55 Van Dam St., New York, N. Y. This preparation is said to have the same antiseptic properties as the tincture of iodine and to penetrate deeply. Isodine-Davis is supplied in two cc. and ten cc. applicators, and in unit cartons containing ten swabs, each of which represents an individual treatment.



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A cylinder shape wood woven barrel that is made to fit into any barrel plating equipment.

For use in Cadmium, Zinc, Copper, Tin, Nickel, Brass, etc.

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MERIDEN, CONN.

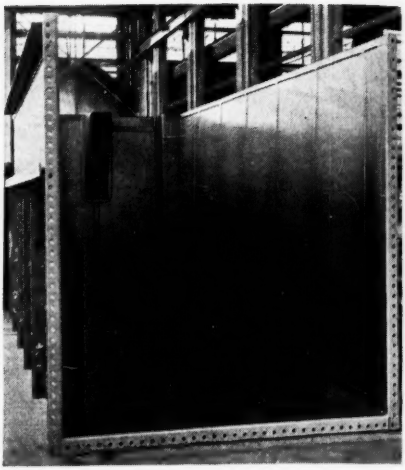
Goodrich Triflex "K" Rubber Lining

A tank lining designed especially for bright nickel plating tanks to be known as Triflex "K" has been placed on the market by The B. F. Goodrich Co., Akron, Ohio.

Since bright nickel plating baths are easily thrown off balance by contamination from traces of foreign matter, it is necessary to keep this type of solution in a non-contaminating type of tank. Triflex "K" Rubber Lining is said to assure non-contamination of the solution.

One of the tests on Triflex "K" consisted of placing samples of the new lining in a Bierer aging bomb containing oxygen under 300 lbs. per sq. in. Pressure at a temperature of 70 degs. Centigrade. This test, according to the manufacturer, is said to be approximately equivalent to eight years of regular service. On subsequent immersion in a bright nickel plating solution containing a wetting agent, Triflex "K" Lining Material did not show a tendency to peel.

Triflex "K" Lining is applied to steel tanks by means of the Goodrich Vulcalock process. By means of this process, a firm bond, even at elevated temperatures, is assured. The application of Triflex "K" Rubber Lining Material can be made either at the factory or in the plant.



Triflex "K" Rubber Lined Tank for bright nickel solutions

Udylite Straight Line Automatic Polishing and Buffing Machine

The Udylite Corporation, 1651 E. Grand Blvd., Detroit, Mich., has announced the development of a straight full automatic polishing and buffing machine which is said to reduce polishing and buffing costs to an absolute minimum. It is stated by the manufacturer that this type of machine will do the work of a number of manually operated

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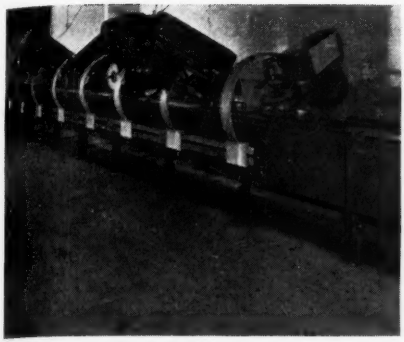


Udylite Straight Line Automatic Polishing and Buffing Machine

lathes. Uniform finishes are obtainable since each piece receives the identical treatment as the one preceding while the parts are carried through the machine on a conveyor.

The outstanding mechanical features claimed for the machine are high productivity and flexibility. The straight line unit shown in the illustration is equipped with eight polishing and buffing heads and is said to be capable of polishing 900 bumper guards per hour with three operators.

In addition to bumper guards, the straight line unit can be used to buff a large variety of pieces ranging from flat to irregularly shaped objects. To change jobs, fixtures must be changed and wheels adjusted.

A constant work pressure control whereby work pressures can be adjusted by a simple operation is one of the outstanding features of the unit. A full floating spindle enables the polishing or buffing wheel to ride gently over the contour of the work being finished. A variable speed conveyor provides speeds from 5 to 40 ft. per minute.

The Udylite Straight Line Automatic Polishing and Buffing Machine can be made any length and with any number of polishing and buffing heads to suit individual requirements.

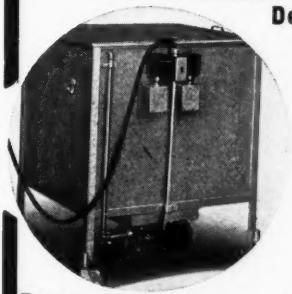
Filter Press Paper

The Enthone Co., 442 Elm St., New Haven, Conn., has announced the sale of a new high strength paper for filter presses, which is claimed to possess maximum wet strength. The paper is said to have exceptionally long fibres, and in addition has been given a patented wet strength treatment.

The paper, costing less than a cent a sheet, is placed against the filtering canvas or screen and the filter cake deposits upon the paper, thus enabling rapid cleaning of the canvas by merely removing the filter paper and carrying away the filter cake.

It is stated that the high strength of the paper, both wet and dry, obviates any danger in tearing, both in placing the paper and removing it from the canvas. The paper, being only a few mils thick, allows tight locking of the

Reduce Metal Cleaning Time with PHILL-CO Portable Degreasers!



Phill-co degreasers remove oil and grease from all types of metal—rapidly, economically, without labor or mechanical action.

Take Degreasers to the Work!

NO INSTALLATION REQUIRED—plug into any electrical outlet and you are ready to degrease. Save unnecessary steps and time. Illustration shows Model 220-9 with power driven flusher. Solvent capacity 10 gallons, cleans from 3 to 6 tons of work. Solvent distilled and reclaimed within each machine.

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plates and frames to prevent leakage.

The paper is fast filtering, and tests by the supplier have shown it to possess high strength in acid solutions with pH values as low as 2.0 and in strong caustic solutions up to 15 oz. per gallon of caustic soda.

Some of the advantages claimed for the use of this paper are: fast cleaning of filter presses; more thorough filtration; longer life of canvas; and tight sealing of plates and frames.

M.S.A. Safety Insole

A protection item for the feet against nails, spikes, sharp metal projections, and other dangerous underfoot hazards has been placed on the market by Mine Safety Appliances Company, Braddock, Thomas and Meade Sts., Pittsburgh, Pa. This protection device is designated as M.S.A. Safety Insole.

The M.S.A. Safety Insole is built of two layers of overlapping steel strips moled in rubberized fabric. The Safety Insole is said to be remarkably light and flexible, bending freely with every movement of the foot, and yet fully capable of preventing injury from penetration of the boot sole by sharp pointed objects.

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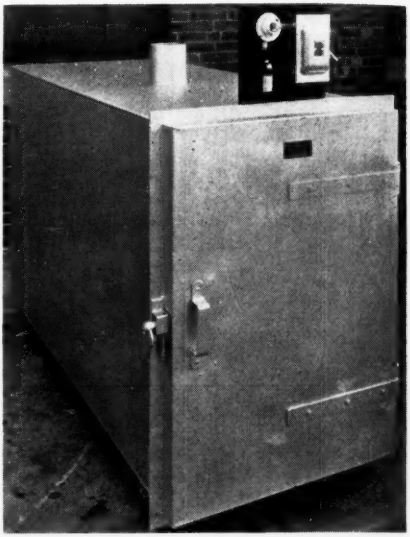
NORTH CREEK, WARREN COUNTY, N.Y.

GKS Cabinet Oven

A small cabinet oven designated as the Model GKS is now being marketed by George Koch Sons, Inc., 2112 Pennsylvania St., Evansville, Ind. The oven



GKS Cabinet Oven

has a capacity of 43 cu. ft. and is equipped with a signal light and explosion-proof spring catch for the door. Thermostatic control is a feature of this oven. The oven may be thermostatically controlled at any point between 100 and 500 degrees.

Stow Multi-Speed Flexible Shaft Machine

An addition of a Multi-Speed Flexible Shaft Machine to the Junior line of Stow Manufacturing Co., Inc., Binghamton, N. Y., flexible shaft equipment has been recently announced. The application of this new unit includes grinding, polishing, wire scratch brushing, and so on.

The Multi-Speed unit is a utility tool which consists of motor with extension cord and plug for any light socket, mounted on a four-caster base which is said to give it an unusually low center of gravity. It is equipped with an ad-

justable arm for regulating belt tension, a three-step cone pulley, a V-belt and a flexible shaft with clamp spindle.

The shaft is designed on the same principle as that used in the Stow heavy duty machines and consists of a rugged over-size flexible core with a tough oil

Stow Multi-Speed Flexible Shaft Machine

resistant rubber outside casing. The motor end of the shaft is reinforced to insure uniform curvature and is fitted with an Oilite bearing. The hand piece is fitted with precision ball bearing with labyrinth oil seal.

The Multi-Speed model is available in either ¼ h.p. or ⅓ h.p. motor, and a speed range of from 875 to 3,500 r.p.m. The shaft sizes are ⅜ in. x 5 ft. for the ¼ h.p. unit and ½ in. x 6 ft. for the ⅓ h.p. unit. The maximum wheel capacity for each unit is 6 in. x 1 inch.

Pickleen

An addition agent for pickling agents to be known as "Pickleen" has been placed on the market by The Enthone Co., 442 Elm St., New Haven, Conn. This addition agent is stated to provide a marked lowering in the surface tension of sulphuric or hydrochloric acid pickling solutions and consequently results in a saving of acids by drag-out.

The addition of Pickleen, according to the manufacturer, also results in a saving of acid by an inhibiting action, but the product is not claimed to be an inhibitor.

It is claimed that the acid pickle containing the addition agent functions also as a cleaner, thus enabling smoother and more rapid pickling action on iron or steel which has not been thoroughly cleaned of all grease or oil. The

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Dries with lacquer speed.
Very flexible baking schedule.
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cleaning action, therefore, is reported to help insure proper adhesion of plated coatings after acid dipping by removing any oil films remaining after alkaline cleaning or normally liberated as fatty acids in the pickle if complete rinsing of the cleaner was not accomplished. It is said to be particularly effective for pickling parts in bulk for barrel plating, hot tinning, or galvanizing due to the fact that complete cleaning is difficult to accomplish in bulk or basket cleaning.

Pickleen is said to be stable in hot sulphuric acid solutions up to 15 per cent concentration and in cold hydrochloric acid up to 1:1 concentrations by volume.

American Bonded Pre-finished Metals

Two pre-finished bonded metals which are said to combine the flashing beauty and durability of chromium with the lightness, strength, and workability of aluminum are now being marketed by American Nickeloid Company, Peru, Ill. These two plated metals will be known as Nickel Aluminum and Chrome Aluminum.

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Absolute uniformity.
Highest quality.
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Longer wear.
Prompt delivery.

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The two metals are formed by a surface of chromium or nickel bonded by an electrolytic process to an aluminum base metal using the Krome-Alume process. Nickel Aluminum and Chrome

American Bonded Pre-finished Metals

Aluminum are adaptable for manufacturing name plates, bottle covers, metal fume vents, and so on. These prefinished metals are available in sheets up to 36 in. x 96 in., in a full range of tempers, and in gauges from .010 in. up to .064 inch.

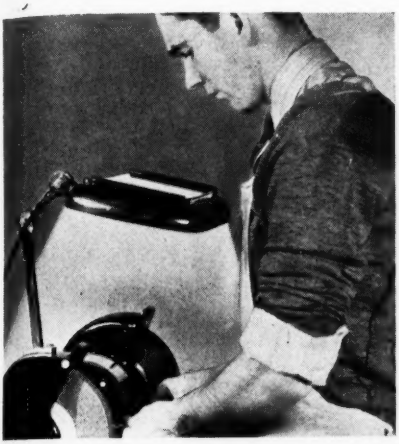
A choice of bright or satin finish and striped, crimped, or corrugated pattern adapts the prefinished metals to many uses and designs. The manufacturer states that both metals are easily workable during manufacturing processes and are highly resistant to corrosion, rust, or tarnish. They can be bent, stamped, or moderately drawn without damage to the bonded coatings.

Marvel Grinding or Polishing Wheel Shield

A protection device for grinding and polishing machines to be known as the "Marvel" Shield has been placed on the market by Boyer-Campbell Company, 6540 Antoine St., Detroit, Mich. The Marvel Shield is mounted on a

completely adjustable cadmium plated bracket. The device consists of a frame of molded, high impact resisting, plastic material.

The light source of the Marvel Shield is focused on the work, thus permitting



Marvel Grinding or Polishing Wheel Shield

better visibility. The shield is equipped with a push button switch, and light which is completely adjustable. The window of the shield is made of non-shatterable glass and the lamps, of bayonet type, are vibration resisting and are set-in flush with the frame.

The streamline design of the Marvel Polishing or Grinding Wheel Shield is said to harmonize with modern grinding and polishing machines. The unit can be adapted to work requiring close limits by the insertion of a magnifying lens in place of the glass window.

H-V W-M Insulating Joints for Electrochemical Pipe Lines

Insulating joints which are recommended for cleaning tanks, plating tanks, and heating and cooling lines have been placed on the market by Hanson-Van Winkle-Munning Co., Matawan, N. J. Plants employing electrochemical processes such as electroplating, electrotyping or electrorefining will find these joints particularly valuable where there is a possibility of electrical currents through the pipe lines used to transfer solutions.

The insulating joints, being of simple construction, are made of malleable iron and include compressed fibre insulating rings which encircle a ball member at two different places. They are tested for 125 volts direct current service and for 200 lbs. per sq. in. steam pressure. According to the manufacturer, these insulating joints may be safely used under hydraulic pressures as high as 1,000 lbs., depending upon the size of the joint. The flexibil-

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DEOXIDINE prepares metal surfaces perfectly for painting.

The **GRANODINES** protect against rust and preserve paint.

LITHOFORM keeps paint intact and lustrous on zinc and cadmium surfaces.

KEMICK, a chemical paint, sticks to metal even when red hot.

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Special grades developed to meet your requirements.
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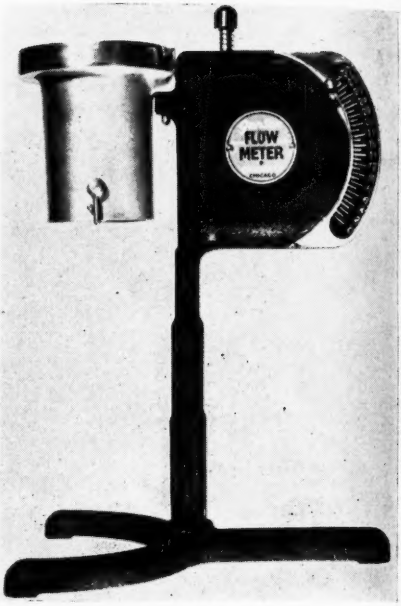
ity of these joints is said to be another advantage inasmuch as they are said to prevent pipe breakage due to expansion, contraction, or vibration strains.

Ganson Flow Meter

Of interest to all who use paints or finishes for industrial work is the Ganson Flow Meter which has been placed on the market by The Ganson Co., 3227 W. Lake St., Chicago, Ill. This unit is designed specifically to provide a scientifically accurate control for the correct mixing of lacquers, paints, or enamels.

The Ganson Flow Meter is said to instantly tell the operator whether his proportions of paint and reducer are correct for obtaining a perfect, trouble-free job. Proper mixture will eliminate effects such as orange peel, blisters, cracks, streaks, and uneven surfaces.

By means of the Ganson Flow Meter, the operator can easily and quickly duplicate any batch of mixed paint. The entire testing operation requires a minute of time. The flow meter is said to be equally effective for any type of finish, whether applied with a spray gun or a brush.



Ganson Flow Meter

The Ganson Flow Meter is solidly made of cast aluminum and neatly finished with wrinkle-baked enamel. Ease of operation and control are said to be the outstanding features of this unit.

Schneible Entrainment Separator

The Claude B. Schneible Company, 3951 W. Lawrence Ave., Chicago, Ill., now has available an entrainment separator which is said to effectively recover air borne liquids. The unit has no moving parts and nothing to regulate or adjust, the design being very simple throughout.

The manufacturer claims effective removal of atomized or entrained liquids arising from various processes or operations and drawn into a ventilating system. The design principle is identical to that of the entrainment separator of the well-established Schneible Multi-Wash Wet Dust Collectors.

Connected into the air intake duct, air

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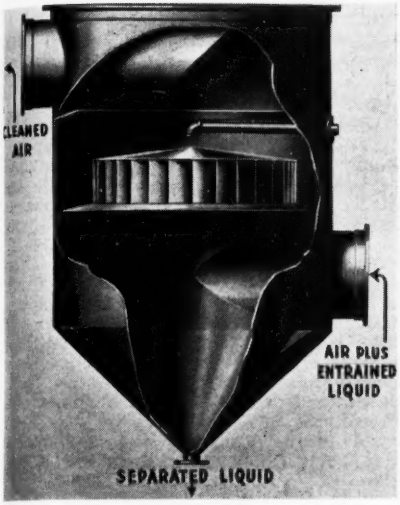

Schneible Entrainment Separator

with its burden of liquid is passed through an impingement unit, of unique design, consisting of a multiplicity of curved vanes vertically imposed upon a shelf with a central opening and with a conical section on top of the vanes with the point upward.

Air or gas entering the unit is rotated, separating larger liquid particles, and then passes through the turbine-like vanes to increase the centrifugal action and impingement growth of minute liquid particles. An anti-creep ring prevents creeping of oil, and so on; the clean air passing on and out into the duct. Separated liquid drips down into a hopper at the bottom of the unit, from where it is drawn off for re-use, salvage or disposal. Often the bottom is connected directly to a sewer.

The impingement unit can be flushed occasionally by means of a water or other liquid introduced just above the conical impingement plate section. The flushing liquid strikes the point of the cone, runs to the periphery and on down over the curved vanes, washing off any sedimentation.

Flushing liquid can be drawn off and salvaged or piped to a sewerage system or otherwise wasted so that it will not contaminate the recovered liquids. Two inspection doors are provided, at top and bottom.

The Schneible Entrainment Separator is designed to remove free moisture from air ventilating—washing processes, pickling processes, plating processes and to extract oils, lacquers, solvents, coatings and other sprayed materials from ventilating air, to free conditioned air of excess moisture after washing and cooling, and for other vapor entrainment purposes.

The manufacturer claims direct savings, as well as nuisance removal, by

ROBERTS WAY
***is the* SURE WAY**
***to* BETTER FINISHES**

Let us send you samples now for convincing proof that ROBERTS rouges and compounds will improve YOUR product at decreased operating costs.

THE ROBERTS ROUGE CO.
904 Longbrook Ave., Stratford, Conn.

Specialists in manufacturing of gold, sterling, and silver plate rouges; stainless steel, chrome, and crocus compounds.

In the March Issue . . .

The second installment of "Electrodeposition of Nickel from Nickel Chloride Solutions."

Another article on metal coloring.

More practical tests for finishing materials.

installations they have made of the equipment where alkali bearing entrainment, acid bearing entrainment or oil bearing entrainment formerly damaged roofs and other property. In other installations, the salvage of costly process liquids has resulted in direct operating savings. Units are available of suitable material and in sizes and types to meet requirements, including vacuum, atmospheric or plus pressures.

Cosol High Boiling Solvents

A group of naphthalene free, refined high boiling coal tar solvents designated as Cosol No. 1, No. 2, and No. 3 are now being marketed by The Neville Company, Neville Island, Pittsburgh, Pennsylvania.

The Cosols have high solvent power, high boiling range, and high flash point. These solvents are said to be slow evaporating and have high gravity. They are practically water-white, have low distillation residue, and a mild, pleasant odor.

Cosol solvents can be used in wire enamels, synthetic enamels, slow evaporating coatings, or wherever powerful, mild odored, slow evaporating solvents are required.

Dyclene Process

The Dyclene Process was developed by MacDermid Incorporated, Waterbury, Conn., to provide several new methods of cleaning zinc and aluminum base die castings. Provided the few recommendations made are closely followed, the plated deposit will not peel or blister even when heated to temperatures as high as 300 degs. F. for one hour. There are two methods by which to obtain this result. Method I involves the two tank cleaning cycle. The first step employing Dyclene "S" is a soaking operation which loosens or removes a great percentage of the impacted buffing compound. It is suggested that the usual water rinse be omitted, the soak operation being followed by the reverse Dyclene "E" solution. This reverse cleaner is said to completely remove all compounds, oils, greases, and inorganic substances. Following this, the work is given the usual water rinses and a one per cent muriatic acid dip.

Anodic cleaning is strongly recommended. Dyclene "E" may be used cathodically. However, the manufacturer states that the benefits gained by using reverse current such as a thoroughly activated surface, elimination of gas absorption, rapid discharge of ionic particles produce a chemically and metallurgically clean surface, thus insuring an adherent bright deposit.

Concentrations of the Dyclene compounds are governed entirely by the interval elapsing between the buffing and cleaning operation, nature of composition used and the size and shape of the article cleaned.

The following concentrations are applied to the majority of cases although adjustments may be made to fit specific cleaning time cycles.

The Dyclene "S" compound which is used only in the soaking operation is generally employed at concentrations between four to six ounces per gallon and at a temperature between 185 and 200 degrees F.

The Dyclene "E" compound which is used only in the reverse electric cleaner is recommended for use at concentrations between two and six ounces per gallon, temperature 165 to 205 degs. F., current density of 25 to 50 amperes per sq. ft., and voltage three to six. The use of removable nickel plated steel

electrodes is recommended.

Method II is designed for plants where an appreciable investment in degreasing or pressure alkali machines has been made and where their continued use is desired. Provided the cleaning in these machines is properly carried out, a 30 to 60 seconds immersion in the Dyclene "E" electric reverse cleaner is said to give a chemically and metallurgically clean surface. For most applications, the concentration of two ounces per gallon, temperature 180 to 210 degs. F., current density 25 to 50 amperes per sq. ft., voltage four to six is said to be satisfactory. Again, concentrations may be varied to fit any specific time cycle.

Dyclene "S" is packed in 100 lb. and 250 lb. wooden containers, and Dyclene "E" is packed in 100 lb. and 350 lb. steel drums.

Sawyer Electrical Catalog. An interesting new catalog has just been issued by Sawyer Electrical Manufacturing Company, 5717 E. Leneve St., Los Angeles, Calif. In it is covered the complete line of air grinders manufactured by the company, as well as high-speed, heavy-duty tool post and pedestal mounted models.

Full information is given on the Sawyer Master Pressure Blowers, Volume Blowers, Sawyer Smithway Portable Submersible Pump, and the Sawyer Hi-Power Grinder line.

A complete line of sanders, as well as high-power rotors and stators, is also included.

Copies of the catalog may be obtained by writing to Sawyer Electrical Manufacturing Company, 5717 E. Leneve St., Los Angeles, California.

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Thousands of every size
8"—8¢ each 9"—9¢ each
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THIS Opportunity Section is available for classified advertisements featuring equipment, employment, business opportunities, etc., in the industries devoted to the cleaning, plating, polishing and finishing of metals. For advertising rates and other information address:

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FOR YOUR *Catalog* LIBRARY

To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Safety Clothing
The Steel-Grip line of safety clothing is briefly described and illustrated in this catalog which is now being issued by the Industrial Gloves Company, 701 Garfield Blvd., Danville, Illinois.

2. Small Capacity Airless Abrasive Mill
A 15 in. x 20 in. Wheelabrator Tum-Blast is described in Bulletin No. 35 which is now being issued by The American Foundry Equipment Company, 555 S. Byrkit St., Mishawaka, Indiana.

3. Polarograph Analysis
An instrument for rapid quantitative and qualitative analysis by automatic recording of current voltage curves is described in this catalog now being issued by E. H. Sargent & Company, 156 E. Superior St., Chicago, Illinois.

4. Cameron One-Two pH Tester
A direct reading pH tester using the glass electrode for field or plant is described and illustrated in a 4-page bulletin now being issued by Wilkens-Anderson Co., 111 N. Canal St., Chicago, Illinois.

5. Production Methods Metal Parts Washing Equipment
A beautifully illustrated 6-page folder describing A-F Industrial Washing Machines is now being issued by The Alvey-Ferguson Company, 200 Disney St., Cincinnati, Ohio.

6. Polymerin-100
A catalog describing Polymerin-100, an industrial finish with exceptionally low-temperature speed baking characteristics, is now being issued by Ault & Wiborg Corporation, 75 Varick St., New York City.

7. Portable Electric Tools
One of the most complete catalogs on Skilsaw Portable Electric Tools for production, maintenance, and construction. Skilsaw Inc., 4743 Winnemac Ave., Chicago, Illinois.

8. "Blacking" Rust Preventative
A 10-page catalog describing the Du-Lite Process, a method whereby steel parts can be colored with a permanent black finish. Du-Lite Chemical Co., Highland Ave., Middletown, Conn.

9. Dust Collecting Systems
An attractive 24-page catalog has just been issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio, which illustrates and describes many K. & B. Dust Collecting Applications installed in numerous industries.

10. Air Filters for Spray Booths
Bulletin No. 244 now being issued by American Air Filter Company, Inc., 133 Central Ave., Louisville, Ky., describes special filters for spray booths that are said to remove spray vapor from exhaust air before it reaches the fan and ducts.

11. Modern Electroplating Control
Modern electroplating control with Sangamo Amperehour Meters is discussed in an 8-page catalog now being issued by Lasalco, Inc., 2822-38 LaSalle St., St. Louis, Missouri.

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12. Bonderizing
The Parker Process that holds paint to steel and resists rust, known as "Bonderizing," is described in this catalog now being issued by Parker Rust Proof Company, 2172 E. Milwaukee Ave., Detroit, Michigan.

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13. New Wrinkle Dispspray
A castings finishing process known as "Dipspray" is described and illustrated in this catalog which is now being issued by New Wrinkle, Inc., Mutual Home Bldg., Dayton, Ohio.

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14. "Tygon" for Process Equipment Linings
A 4-page folder describing "Tygon" as a lining material for process equipment. The U. S. Stoneware Co., Akron, Ohio.

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15. Custom-Built Finishing Equipment
A 24-page catalog presenting various problems encountered in the cleaning of metal parts and describing the methods and machines used in the solution of these problems. N. Ransohoff, Inc., 212 W. 71st St., Cincinnati, Ohio.

16. Ross Metal Decorating Oven
A complete description of the equipment for baking decorative coatings on metal is now being issued by J. O. Ross Engineering Corporation, 350 Madison Ave., New York City.

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17. Woven Wood Plating Barrel
Folder describing many features of the King woven wood plating barrel. John King, 48 Springfield St., Dayton, Ohio.

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18. Paint Adhesion for Zinc or Cadmium Surfaces
A method for obtaining paint adhesion for galvanized iron and other zinc or cadmium surfaces by means of Lithoforming is described in the catalog which is now being issued by American Chemical Paint Company, Box 303, Ambler, Pennsylvania.

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19. Economical Degreasing
A series of leaflets covering practically every phase of metal degreasing are now being published by Detroit Rex Products Co., 13017 Hillview Ave., Detroit, Michigan.

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20. Airway Ventilated Buffs
Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 21-03 41st Ave., Long Island City, New York.

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